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# Proceedings of the 2014 e-Skills for Knowledge Production and Innovation Conference

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(Late paper accepted by executive review)
Preface

The e-Skills for Knowledge Production and Innovation Conference (e-Skills 2014) is a collaboration between the Ikamva National e-Skills Institute (iNeSI) and the Informing Science Institute (ISI). iNeSI, as part of its mandate, is responsible for creating a platform to promote new knowledge for innovation in South Africa. ISI provided academic paper review and support for delegates.

The e-Skills conference aims to address issues of interest to individuals, business, government, and civil society, promoting e-literacy, e-astuteness and in developing and supporting e-skills (ICT skills) at all levels of life and work. The focus of the conference is the strategic and efficient use of modern ICT devices and applications as well as the related knowledge, skills, competences, teaching, learning, and inventiveness of the workforce and citizens. The conferences promotes research that provide insights for improving effective appropriation of modern ICT devices and applications into service delivery, more effective use of service delivery by citizens, business efficiency, entrepreneurship, education and more cohesive and equitable living in society. We particularly stress the importance of evidence-based research and approaches that are found to be effective.

About the Ikamva National e-Skills Institute

The Ikamva National e-Skills Institute (iNeSI) has been specifically developed to suit South Africa’s needs following six years of incubation and testing within Department of Communications. It has benefitted from first hand examination of international best practice in Korea, USA, Mexico, UK, Ireland, Kenya, Rwanda, Australia, New Zealand, and Cuba. The process has been supported by formal agreements with more than 30 key national and international stakeholders across Government, Business, Education, Civil Society and international donor agencies. iNeSI operates as a catalytic aggregator of effort to support South Africa’s National Development Plan (NDP); an identifier of overlap, duplication and gaps; a motivator, leader and facilitator of evaluation of impact of interventions; and as a lead contributor to policy development to address inequity and poverty through appropriation of modern ICT devices and applications. iNeSI supports impactful trans-disciplinary research methodologies and is in the process of building increased South African capacity in Case Method (research and discussion) as a means to more effectively analyse and engage multi-disciplinary stakeholders in improving South Africa’s global e-readiness rankings. iNeSI welcomes all researchers and seeks to develop collaborative, comparative and longitudinal studies that can improve policy, praxis, teaching, and capacity in participant jurisdictions.

Dr. Harold Wesso
Acting Chief Executive Officer, iNeSI

Mymoena Sharif
Chief Director: iNeSI

Dr. Walter Claassen
Dr. Wallace Taylor
Research Network for e-Skills (ResNes)
About the Informing Science Institute

Informing science is the transdisciplinary study of systems that employ information to impact clientele. The mission of the Informing Science Institute is to:

- Support transdisciplinary research that furthers our understanding of the construction and evolution of systems that inform, providing free and open access to such research,
- Foster communication among disciplines that study informing and education, and
- Nurture a supportive global community of informing science researchers through mentorship and through providing opportunities and venues for collaboration.

The Informing Science Institute’s (ISI) primary reason for existence is to promote the advancement of the informing science transdiscipline across the global research community. Three principles guide the ISI’s research and publication agenda:

- Open access: All ISI publications, including conference proceedings, journals, repository contents and books, shall be accessible in their electronic form at no cost to readers.
- Global outreach: The ISI’s research agenda shall always be framed with the global community in mind, and shall not be limited by the perceptions and priorities of a particular nation.
- Mentorship: Helping researchers develop and refine their craft is as central to ISI’s philosophy as providing outlets for the efforts of established researchers. This mentorship mission applies to both the conferences run by ISI and to the review and publication policies of its journals.

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Faculty of Commerce, University of Cape Town

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E-skilling on Fundamental ICT Networking Concepts – Overcoming the Resource Constraints at a South African University

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Abstract

Year-on-year, the number of new learners entering higher education institutions continue to increase. This is positive when one considers government strategic interventions such as the ICT Policy and strategic intervention 4: Realizing Digital opportunity of the National Broadband Policy 2013 that highlights “uptake and use enabled through institutional capacity and individual capability and institutional absorption” as an intended outcome. Consequently, the demand for professional human resources to manage the broadband infrastructure at different levels increases.

However, higher education institutions are faced with the challenge of capital expenditure on technical equipment for training the ever-growing number of first-year students. As capital expenditure budget is lagging behind students intake (notably their skills practice need), it is imperative to investigate how best can higher education institutions leverage on limited resources to train students especially ICT students?

This paper posits that a visual ICT networking design and simulation platform, introduced as part of active learning rather than just open distance learning, provides assistance to higher education institutions faced with dilemmas of how to teach growing learners the foundational understanding of theoretical ICT networking concepts. The higher education institutions would not only be able to address the need for equitable ICT networking equipment, manage class interaction and assessment for rather large groups but also leverage on the evidence-based advice from this study to efficiently train learners (future job seekers and/or e-astute citizens) that would be empowered to work effectively with technology.

Keywords: e-skilling, Large Classes, Learning, Active Teaching, Bloom’s Taxonomy, Connectivism, Network Simulation, Packet Tracer.
Introduction

There are an increasing number of initiatives in South Africa (SA) aiming to take advantage of the soon-to-be ‘inherent’ ubiquitous broadband pervasiveness, as an enabler to transforming lives and growing the Gross Domestic Product (GDP). Some of these initiatives include Tshwane Metropolitan’s Project Isizwe (see projectisizwe.org), Western Cape Provincial Broadband Initiative (WCBBI) and the National Department of Communication (DoC) led SA Connect broadband policy (DoC National Broadband Policy, 2013) and ICT Policy (DoC National Integrated ICT Policy, 2014).

The ITU (International Telecommunication Union) acknowledged broadband technology as a contributor to economic growth at several levels (Katz, 2012). Qiang et al. of World Bank found that in low and medium income countries (such as South Africa), a 10% increase in broadband penetration yielded an additional 1.38% in GDP growth (Qiang, Rossotto, & Kimura, 2009). Whilst impact of broadband is absorbed to varying degree in different countries, broadband absorption drives intensive, productive use of ICT, online applications and services, thus making it possible to improve processes, introduce new models and structures, and drive innovation (Qiang et al., 2009). An intensive and productive use of ICT (apart from business strategic advantage) is seen in the increased engaged use of ICT by individuals and communities. Strategic intervention 4 (Realizing Digital opportunity) of the South Africa National Broadband Policy 2013 (DoC National Broadband Policy, 2013; Appendix), highlights “uptake and use enabled through institutional capacity and individual capability and institutional absorption” as an intended outcome.

Parts of the metrics used for measuring these outcomes include:

- Increase demand side skills: ICT specialists …
- Number of PhDs in area of ICT

As broadband becomes ubiquitous, the demand for professional human resources to manage the broadband infrastructure at different levels of semi-skilled, skilled, expert and strategic level increases. To achieve on this, there is need for an increased post-school feeder of technical and undergraduate degree students specializing in technical and process elements of ICT, as well as leveraging ICT for business imperatives. As student numbers increase, so do the need for space, teaching aids and equipment they require for hands-on training in their study increase.

A problem faced by higher education institutions (HEI) is that with the increased number of students intakes, comes the requirement for more proportional ICT equipment for training (Sun, Wu, Zhang, & Yin, 2013). However, most institutions in South Africa are faced with budget constraints as capital expenditure (capex) on new and/or upgrade of equipment for students’ hands-on skills practice is limited. Though a resource-challenge is universal, it is more pertinent in South Africa with its dual economy paradigm. This results in situation where there is limited resources to train the ever growing number of first-year students (especially ICT students). Consequently, these institutions are faced with dilemmas of how to teach the growing number of learners with 1) apt learning and teaching for understanding abstract ICT networking concepts, 2) equitable ICT networking equipment to learn the networking concepts, and 3) managing class interaction and assessment for rather large groups. For ease of paper flow, the question arising and approach to studying these dilemmas are looked at in later sections: “Research Domain” and “Research Design”.

Structure and Approach

In this paper, the elements of learning for understanding noting Bloom’s learning taxonomy (Anderson, Krathwohl, & Bloom, 2001) and Connectivism (Conradie, 2013) are looked at. A visual network design and simulation platform was then reviewed as an appropriate platform for
learning ICT networking concepts. Following is the mapping of learning for understanding with the visual network design and simulation platform at a university in South Africa. The study was partly based on Participatory Action Research (PAR) (Chevalier & Buckles, 2013) taking cognizance of Freire’s critical pedagogy (consideration of how education can provide individuals with the tools to better themselves) (Howlett, 2013, p. 248). This paper concludes with an inference on the appropriateness of the platform as a learning tool to assist in achieving skills critical mass, required for effective broadband absorption.

**Learning for Understanding: A Review**

Year-on-year, the number of first year students entering the South African university system currently at one million (DHET, 2014, p. 7), is increasing at a rate that poses challenges for most universities in South Africa (Davids, 2014). With a growing student volume in class rooms, comes decreased student-tutor interaction and reliance towards large group teaching methods that tend to deliver information to a silent and passive student body (Surgenor, 2010). A notable strain comes to fore as the ever-expanding group of first-year students are taught with teaching aid resources that does not increase proportionally (Davids, 2014; Sun et al., 2013). In a number of universities in South Africa and the researched university in particular, students come from high schools where learning were more carefully controlled and structured through the school curriculum system (mini projects for some in grade 12). These students are then re-oriented to utterly different styles of teaching, learning and assessment (Surgenor, 2013, p. 289) when they get to university – a less structured environment than grade and high school. Added to this complexity, is the reality that students at South African higher education institutions (HEI) come from a variety of racial, cultural, linguistic and socio-economic backgrounds; such cross-cultural interactions and differences, even if mutually satisfying, may result in educational experiences and outcomes not being successfully achieved across board (Moutlana & Moloi, 2014, p. 53). The Department of Higher Education and Training (DHET) white paper (Jan 2014) mandates HEI to focus their attention on improving students throughput rates notably in scarce and critical skills needed for South Africa's economic development. ICT is one of these skills. A core component of the ICT skills especially relating to broadband is networking. How then can a large number of students be introduced to ICT networking; a foundation on which subsequent advanced ICT concepts are built?

**Cognitive Learning**

A view of the scholarship of teaching and learning is active learning/engagement (Moutlana & Moloi, 2014, p. 52). ICT has become a critical component of active engagement especially in blended learning (Conradie, 2013; DHET, 2014; Hauge & Riedel, 2012). Freire’s critical pedagogy requires a revamping of traditional treatment of students as ‘empty pots’ that passively receive knowledge from authoritative teachers, to active engagement wherein students tend to learn, participate, explore and exhibit creative power and the ability to transform their own lives (Chevalier & Buckles, 2013; Howlett, 2013). Connectivism (as a combination of constructivism and cognitivism) could then be integrated as a component of blended learning environment to achieving active learning (Conradie, 2013). The learning environment must in effect provide students with progressive learning opportunity. In actual fact, face-to-face contact sessions must be supplemented with ‘non-contact’ connectivism (or online instruction) to achieve progressive learning. Not only will knowledge not be monopolized but also students engage in action learning (Chevalier & Buckles, 2013; Conradie, 2013; Moutlana & Moloi, 2014). Hence, this paper is not primarily focused on pure online learning, open distance learning (ODL) or massive open online curriculum (MOOC). Neither, does it explore the full spectrum of constructivism nor the specifics of connectivism (Siemens, 2005). It narrowed in on blended learning with particular focus on a
E-skilling on Fundamental ICT Networking Concepts

A platform that can be used to train students on the acquisition of ICT networking skills through the use of a ‘virtual’ environment rather than physical hardware equipment.

**Learning Taxonomy**

Educators have for long set learning objectives based on Bloom's taxonomy – including its revision and critique thereof (Anderson et al., 2001; Paul, 2012). It is broadly divided into three domains: cognitive (“knowing/head”), affective (“feeling/heart”), and psychomotor (“doing/hands”). Within these domains, it is expected that learning at the higher levels is dependent on having attained prerequisite knowledge and skills at lower levels (Orlich, Harder, Callahan, Trevisan, & Brown, 2012, p. 92). Bloom’s three domains and sub categories remain relevant in systematizing learning objectives. This in spite of other schools of thought such as critical pedagogy/thinking highlighting seemingly lack of systemic rationale of construction in Bloom’s three domains (Anderson et al., 2001; Paul, 2012, p. 519) and hence non-agreeing with the Bloom’s lower-to-higher level (sequential, hierarchical link). Paul (2012, p. 521) labeled this as “one-way hierarchy.

**Research Domain**

What is paramount then, is knowing how (large group) students develop and demonstrate understanding in a new knowledge field (Wiske & Breit, 2010, p. 7) such as ICT networking via the active learning sphere. Wiske and Breit (2010) reason that through a series of guided performances, teachers help students to gradually acquire new knowledge, along with the ability to apply knowledge in creating increasingly sophisticated products and performances.

An area found lacking in literature is how students learn particular facts in ICT networking and develop skills using a visual network design and simulation tool. Drawing from the research problem area and literature review of learning for understanding, a question to be asked is “as capex budget is lagging behind student intake (skills practice) need, how best can higher education institutions leverage on limited resources to train students especially ICT students?”

The research question then is “can the use of visual network design and simulation platform substitute or complement physical equipment in skilling up large group first-year students in the fundamentals of ICT networking concepts?” A derived question then would be “to what degree can the use of visual network design and simulation platform assist students in learning ICT concepts?”

Comparative learning using a visual network design and simulation tool and physical networking equipment or a mix of both, is excluded from this research. Equally out of scope is the positioning of learning in online learning and open distance learning. The actual level of skills acquired or the direct comparison of physical equipment to ‘virtual’ simulation are not the focus of this research study.

**Visual Network Design and Simulation**

The United Kingdom Open University (UKOU) offers its introductory ICT networking (T216) course to over 600 ‘experienced learners’ as part of a degree program (Moss & Smith, 2010). Unlike the UKOU T216, the foundational ICT networking course at the researched university is offered to over 350 students who were not expected to have prior knowledge of networking computers, their use in the workplace and basic ICT literacy skills. In fact, the students simultaneously take supporting courses in basic office productivity skills and IT essentials (learning about computer parts). The challenge that is faced is profound.
In the case of UKOU, students were able to (via NDG’s NETLAB) remotely access and work on physical equipment in the lab. However, at the researched university, students are not provided access to physical equipment in their first year. Rather, they make use of visual networking and network simulators. The risk of ‘breaking’ or damaging expensive lab equipment are minimized especially by students who were inexperienced in using ICT equipment at the commencement of their first year at varsity.

Equally challenging is that concepts of ICT networking is theoretical and tend to be abstract in nature. Additionally, teaching where a higher level of students’ imagination is necessary to understand advanced topics can be a daunting task in itself. Technology need to be leveraged on to scale hands-on ‘equipment’ availability to the large group and positively support learning without necessarily relying on technology in its entirety. Visual learning techniques provide a means to visually see how ‘things’ really work, to actively engage with it in progressive learning and for teachers to present the subject using animations and practical examples, rather than just talking about theory facts and formative assessment (Janitor, Jakab, & Kniewald, 2010).

**Simulation and Learning**

In the network technology field, practical hands-on skills are valued by potential employers (Makasiranondh, Maj, & Veal, 2010). With lab kits cost for ten students divided into five groups at over US$10000, most universities might not be able to afford the aggregated cost of providing dedicated network devices to student (Sun et al., 2013). Sample pricing available at Cisco Network Academy Program site (Cisco Academy, 2006). Network simulators and emulators have been used to teach technical and theoretical networking concepts (Breslau et al., 2000; Frezzo, Behrens, & Mislevy, 2009; Makasiranondh et al., 2010; Moss & Smith, 2010). Though there exists a difference between network simulators and emulators, offerings such as GNS3 combine both platforms, while OMNeT++ is a general purpose discrete event-based simulator (Weingartner, vom Lehn, & Wehrle, 2009) used for theoretical network protocol study. Other mixed platforms are commercial OPNET, Common Open Research Emulator (CORE), and hybrid ns2/ns3.

Studies by Breslau et al (2000), Frezzo et al (2009), Moss and Smith (2010) illustrate that network simulation platforms are able to address the needs of scalability of hardware experience, flexibility of hardware experience, visualization support for learning the abstract concepts and concrete skills of designing, configuring and maintaining data networks, and learning the inner working of ICT networking protocols. Frezzo et al (2009) further note that the Cisco Packet Tracer supports authoring and deployment of complex skill assessment (which is a key component of Bloom’s taxonomy psychomotor).

**Network Simulator Selection**

**Cisco Packet Tracer**

The Cisco Packet Tracer (shown in Figure 1) is a network simulator that allows students to experiment with network behavior and ask “what if” questions. It is an integral part of the Cisco Networking Academy Program’s (CNAP) comprehensive learning experience providing “simulation, visualization, authoring, assessment and collaboration capabilities.” It further facilitates the teaching and learning of complex technology concepts (Cisco Academy, n.d.).

**Graphical Network Simulator**

The GNS3 network simulator is free and open source software (GNS3, n.d.), unlike Packet Tracer that is only free for students to use whilst they are a student of an academy. GNS3 presents net-
work devices as ‘empty shells’, each requiring an ‘Operating System’ image to be loaded. As such for a student to work on a visual representation of a network device (for instance a router) the actual image of the router must be loaded. For Cisco devices, it seems there might be a licensing violation. Nonetheless, GNS3 offers more choice of network devices that can be represented and hence more hands-on skills practice variety.

**Network Simulator choice**
Packet Tracer is used by choice because it is 1) the de-facto for CNAP, 2) easy to install (Windows and Linux) and a ‘get started’ platform for students that are just starting out in ICT networking.

**Learning in Network Visualization and Simulation**
The challenges faced with large groups of students learning ICT networking concepts included not only learning capability, teaching for understanding but also physical hands-on logistics. The lessons learnt are highlighted below with regard to alternate access to physical hands-on logistics by using a virtual networking design and simulation platform.

**Research Design**
355 students registered for the Networks-1 course at the beginning of the year. About two-thirds are new students in 2014 and the remaining are repeating students. The students were allocated into six lab practical groups according to the university’s lecturing time-table.

Hubball and Clarke (2010) who adapted participants’ observation (Kawulich, 2005; Mack, Woodsong, MacQueen, Guest, & Namey, 2005) from social science and medical research to scholarship of teaching and learning (SoTL), noted that appropriate combinations of qualitative (teaching and learning observations, student response feedback forms, participant narratives …) and quantitative (use of online learning tools, rating and rank-order preference scales …) data sources can yield reliable and critical information to enhance SoTL. In this paper, the visual networking design and simulation platform was used as a learning tool along with teaching and learning observation as qualitative data source. The primary quantitative data source is the questionnaire based ranked-order preference scales. Participants’ mini-narratives in the form of open-ended responses assisted in correlating observed responses with ranked responses, hence triangulating result findings.

The qualitative study utilized in this study involved 1) students’ usage of the visual network design and simulation platform, 2) researcher’s participation via observation and corrective actions. Students were gradually introduced to Packet Tracer as an ICT network design visualization and network simulator tool. Students were carefully observed (Chevalier & Buckles, 2013) for a semester duration. The “Introduction to Networking” course is nonetheless a year-long module. Per participatory action research (PAR) approach (notably participation observation), observations were made with corrective actions where required. The quantitative questionnaire study assisted in correlating the observations made during the qualitative study. Open ended questions were used to correlate student usage viewpoints, researchers’ observation and students’ responses to questionnaires.

**Qualitative Study**
The primary qualitative study in this research is based on participant observation which is a “process enabling researchers to learn about the activities of the people under study in the ‘natural setting’ through observing and participating in those actions.” (Kawulich, 2005) The observation was done in students’ ‘natural lab environment’ which takes place once a week over the duration
of the course. Hence, there is no need for recruitment or selection of students as participants. Not only were students observed during their lab sessions, but requisite interventions were taken to address observed gaps per the principle of PAR.

**Bringing up to speed: Students’ introduction to Packet Tracer**

In the first week of lab practical, students were welcomed and shown how to log into the Moodle “LEARN” site (basic web browsing exercise). In week two, they were introduced to the Packet Tracer 6.0.1 interface and help menu (content, tutorial), watched an introductory video and navigated the Packet Tracer program. Students were introduced to the Packet Tracer (PT) as a fun, take-home, flexible software program in week three. They then started engaging the Packet Tracer as a network simulator that emulates real life network environment. In week four, the students designed a basic network. They started viewing the Packet Tracer as a visual network design and simulation platform that allowed them to build network models, and ask "what if" questions.

![Packet Tracer lab activity teaching students OSI layer 1 and 2: how to connect wired and wireless network](image)

Shown in Figure 1, are some screenshots of the lab activities where students connect network end and intermediary devices using appropriate network media. They also drilled down to physical level to see the devices in cabinet rack in office computer room and table top at home. They then observed on the devices the network interface ports they were connecting to.
Observation of Students’ use of Packet Tracer and interventions

The lab activity for week 2 was initially planned as part of week 1. However, it was observed that a sizeable number of the students struggled with basic IT tasks (in itself). This brings to the fore Moutlana and Moloi’s (2014) stark reality of the complexity that South African HEIs face with respect to students coming from a variety of racial, cultural, linguistic and socio-economic backgrounds. Spreading the introductory lab activities over two weeks eased the students into the networking course.

Another participatory action research (Chevalier & Buckles, 2013) activity undertaken, was forcing attendance and participation in lab session activities through:

1. Enrollment into lab groups when student attended the lab session physically for the first time

2. Submission of lab activity Packet Tracer on the Moodle Learning Management System (LMS) based system at the end of each lab session. It was observed that certain students changed their fellow students’ completed Packet Tracer file name and uploaded the file as theirs. The university has disciplinary measures in place to handle contravening acts in this regard. With the focus being on learning and teaching for understanding, other compensatory controls were introduced.

3. At the end of each lab session, the students took an online quiz based on the lab activities that they had just completed. Lab quizzes were refined over time to include lab hands-on and lab activity formative assessment questions as shown in Figure 2.

4. The implementation of an IP address lockdown ensured that students that were absent from the lab do not attempt the lab quiz from other locations. Students using their laptops in the lab had to give their IP address to the lecturer before being granted access to write the quiz.

5. Activity completion tracking was enabled in the Moodle based LMS that ensure that students download the lab activity Packet Tracer file before they could attempt the lab quiz and only then could they upload their completed Packet Tracer file.

The five learning interventions mentioned, were found to effectively increased student’ engagement in lab activities and also lab attendance.

Quantitative: Survey

The networking course’s purpose states that “on completion of this subject, the student should have a solid grounding in the fundamental networking concepts and technologies. The student will have learnt both the practical and conceptual skills that build the foundation for understanding basic networking.”
Questionnaire
The students were asked to complete an online questionnaire during their group’s lab session towards the end of the first semester to further assist in correlating the observations made and participatory intervention actions. An eighteen (18) question questionnaire was carefully constructed on Moodle the Learning Management System (LMS). The questions are geared toward knowing when and which network simulators are in use, how the reported simulator is being put to use. Two hundred and fifteen students (n=215) completed the questionnaire during their weekly lab group session. Though their responses were received as “Anonymous”, the system did not allow a student to take the questionnaire more than once. Further, students were only able to complete the questionnaire during their lab session when they are physically present. This approach ensures that responses are valid responses from intended students and not from possible ‘unknowns’.

Questionnaire result: Students’ use and experience of PT
When asked if they “have used Packet Tracer (PT) before 2014”, about two-third (67%) replied “No”. A further probing question indicated that about a third (31%) have used PT before the commencement of the networking course because they are repeating the course. It is imperative to gain insight into students’ engagement with PT.

Three-fifth responded that they “own a PC/laptop or have access to a dedicated PC/laptop and have PT installed” indicating possible personal usage. The majority of these respondents listed PT version 6.0.1 as their installed version (latest version at the time). A natural progression then would be to know how they put PT to use.

A response of 41% who on average use PT once a week after lab sessions and 15% twice a week might not be encouraging but does give an indication of after-hour usage. This is supported by a shift towards a likert scale “agree” score by over two-third of respondent of PT (lab activity instruction) facilitating learning technical networking concepts as seen in Figure 3.

PT Activity window
1 (does not), 2 (limited learning), 3 (do not think so), 4 (agree), 5 (definitely Yes/Ja/Ewe)
Allow me to learn networking concept on my own 3.4
Provide guidance I need to learn 3.7

PT network simulator
None (1) | Low(2) | Moderate(3) | High(4) | Very High (5)
confidence level in exploring networking concept 2.8
confidence level in designing basic networking 3.0

facilitate learning technical network concepts 3.0

Figure 3 Questionnaire response on visual learning in Packet Tracer
In Figure 3, the 3.4 (likert scale score) is of essence as this can be construed to imply that other learning modes are required. The students have a two lecture period contact time for lecturing (one hour and twenty minutes) with the lecturer and supplementary teaching (voluntary) of one hour weekly with a senior tutor (a PhD student). The gradual shift away from the middle 3.0 towards the 4.0 agree (likert scale score) shows that with more targeted Packet Tracer activities, the students might be able to leverage Packet Tracer even more. This is important as a 2.8 (likert scale score) of students’ confidence level in exploring networking concept through the use of
Packet Tracer is not strong enough. Just a little above 50% have a moderate and 16% high confidence level.

Regardless, Packet Tracer is seen as moderately increasing students’ confidence in exploring ICT networking concepts and visually designing ICT network topology. Though moderate, the authors concur with Janitor et al.’s (2010) visual learning technique that Packet Tracer visually facilitates the learning of technical ICT networking concepts. Hence, a visual learning technique provides a means to visually see how ‘things’ really work and to actively engage with it in a progressive learning style. Visual learning include video animation, drag-n-drop, what-you-see-is-what-you-get among other supports. Visual learning techniques supported by Packet Tracer are the visual design of networking topology (‘realtime mode’) and the visual inspection of networking events (‘simulation mode’). It is recommended that more activities be carefully designed in this regard. Packet Tracer allows a lecturer to design experimental activities for students to do during lab sessions and also to take away with them after the lab session to further practice with on their own.

In Week 9 lab, navigating to physical mode in PT assisted me in understanding how to physically wired a network device better

<table>
<thead>
<tr>
<th>Moderate (3)</th>
<th>Yes to some extent (4)</th>
<th>Definitely Yes (5)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gain understanding of OSI Layer 1</td>
<td>2.9</td>
<td></td>
</tr>
<tr>
<td>Physical Copper Straight-through cable</td>
<td>3.4</td>
<td></td>
</tr>
<tr>
<td>Physical Copper Cross-over cable</td>
<td>3.4</td>
<td></td>
</tr>
<tr>
<td>Physical Fiber Cabling</td>
<td>3.3</td>
<td></td>
</tr>
<tr>
<td>Wireless network media</td>
<td>3.3</td>
<td></td>
</tr>
<tr>
<td>Physical placement of devices in cabinet rack …</td>
<td>2.9</td>
<td></td>
</tr>
<tr>
<td>Physical placement of devices on table top …</td>
<td>2.9</td>
<td></td>
</tr>
</tbody>
</table>

Figure 4 Visual learning of OSI layer 1 and 2 in PT

Contrary to the opinion that network simulators such as Packet Tracer does not provide students with important practical skills, such as cabling and physical connectivity, the students’ engagement with Packet Tracer via the “Physical view” shown in Figure 1 provided them with some insightful knowledge of the Open Systems Interconnection (OSI) layer 1 and 2 concepts (Frezzo et al., 2009, p. 108; Makasiranondh et al., 2010, p. 321). Students’ responses in Figure 4 indicate that they do not feel totally disadvantaged learning about network media. This is evidenced in the physical layout of SICT Academy Router1 and SICT Academy Switch on the Rack in Figure 1, constructed during lab session. Nevertheless, wiring up network devices and network media (especially cable) termination are skills that must still be experienced physically!

**Correlating Qualitative with Quantitative**

Below are some of the open comment responses (as-is) provided from students’ viewpoints.

“I have a lot of interest in Packet Tracer and i would like to learn more about it”

“PT Played a vital role on helping me to understand the networks better.”

“I don't understand it because I don't have enough time to practice and network notes are too long but I will strive and do my best to pass.”

“more time needs to be dedicated to command prompts”

“HOW ABOUT WE BE GIVEN ENOUGH TIME TO WORK ON PT PRACS AND QUIZES (sic) !!!!!!!!!!!!!!!!”

“I am still finding it difficult to do packet tracer sometimes because its (sic) too fast and I am a bit slow when it comes to networks and actual seeing what is needed in a curtain (sic) activity”
“i am struggling to learn and understand packet tracer.”

Students’ open ended responses provided some insight into how they responded to the questionnaire and their perception of the usefulness of Packet Tracer (the selected visual network and simulation platform).

Students view Packet Tracer as a visual network design and simulation platform of interest that better assists them in learning about and understanding ICT networking. Prior to the time of the survey (completed after their lab session), students submitted their completed Packet Tracer file (lab activity). This might have resulted in some of them ‘racing’ through the lab activity rather than engaging Packet Tracer to learn the objectives of the lab activity. It is no wonder then that some of the students have raised this in their responses. A corrective action taken thereafter was to ensure that students attempted the lab quiz before leaving the lab and only those who were in the lab and attempted the lab quiz were able to submit their Packet Tracer file later in the week, thereby giving them enough (and extra) time for their weekly lab activities.

Comments such as “struggling to learn and understand packet tracer”, among others, correlate well with the mid-range responses seen in the survey. It can be deduced that leaving students alone to learn networking via Packet Tracer would be unsuitable for learning (in its entirety, especially in an open distance learning). They must still be guided during lab activity, as is done (and should be increasingly done). More so, there must be greater alignment between lectures on concepts and practical sessions on the concepts.

From this research study, it can be shown that the use of a visual network design and simulation platform does not yet substitute for, but rather currently complement physical equipment in技能ing up large group first-year students in fundamental of ICT networking concept. However, careful introduction of a visual network design and simulation platform does assist students in learning ICT concepts to some noticeable extent, as seen in 1) Figure 3, 2) the open-ended responses and 3) direct observation of students (participants). In addition, just-in-time assistance and interventions must be provided to the students during lab hands-on sessions. Students must nevertheless still be able to think with this knowledge and apply it in creative ways to transform their own lives (per principle of critical pedagogy and connectivism).

Five corrective learning interventions were highlighted earlier under the Qualitative Study section. Such interventions are required to optimize the usage of a visual network learning and simulation platform. It is imperative that through 1) careful planning, 2) targeted lab activity instruction, 3) encouraged active usage, 4) just-in-time learning interventions, and 5) visual network design and network simulators (such as Packet Tracer), learners will be assisted in learning ICT networking concept (and ICT in general). Nonetheless, for low-level networking investigation, other discrete-event network simulators such as OMNet++, NS3 et al might be more appropriate.

**Conclusion**

The ICT industry (DoC National Broadband Policy, 2013, p. 34; DOC National Integrated ICT Policy, 2014, p. 54) and Internet of Things or Internet of Everything (Mahoney & LeHong, 2012) globally powered by ubiquitous broadband has necessitated the need for a skills feeder (ICT networking critical mass). Post-school training providers especially universities are faced with large first year classes (in excess of two hundred and sometimes more than five hundred). Yet, availability of ICT training kits is not growing at the same proportional rate. Integrating visual network design and simulation platforms into active learning/engagement at these institutions would assist in facilitating appropriate foundational and functional ICT networking skills development. The optimal usage of the platforms does ensure that knowledge is passed on to the much desired ICT professionals of the future. DoC (inclusive of South African iKamva National e-Skills Insti-
E-skilling on Fundamental ICT Networking Concepts

tute (iNeSi)) and DHET are able to deliver on their mandate of skills development to support (DHET, 2014; DoC National Broadband Policy, 2013) and use the accelerated broadband infrastructure.

Active involvement of the lecturer, as is typical in other participatory action research studies (Chevalier & Buckles, 2013; Kawulich, 2005; Mack et al., 2005), might be conceived as introducing elements of bias, which may impact on objectivity. Another limitation to also note is that there still exists some sort of authoritative learning outside the simulation platform as students are still guided by a lecturer. This is a limitation per principle of connectivism though essential per the research finding. Nonetheless, the focus of the research is the degree of learning (ICT networking fundamental and skills) that possibly takes place while using the simulation platform when physical networking kits are not available due to low capex funding.

Future longitudinal and participatory action research studies could assist in further seeking to ascertain if taking of labs using Packet Tracer challenges students, to establish how far the students are challenged, and also how the use of the network simulator builds their confidence. A comparative study of the use of alternate network simulators (and physical devices) as part of future research may assist in a multi-dimensional viewpoint.

Though the use of a simulation platform is not entirely new in higher education institutions, the careful incorporation of visual network design and simulation platform into the teaching of learners that are new to ICT networking is a contribution that most higher education institutions would find useful as they battle with increasing costs of physical equipment to train the ever growing number of first-year learners.

In the current iteration, the use of a visual network design and simulation platform cannot be seen as ‘the’ outright replacement for physical training kits. Rather, its careful integration as part of blended learning (active teaching) approach, is a starting point that would improve e-skilling. Further research into the dependence on the student's urge to learn more about the subject field and willingness to use a new platform to learn, will be important in teaching pedagogy.

References


E-skilling on Fundamental ICT Networking Concepts


Appendix

SAMPLE QUESTIONNAIRE RESPONSE:

Cisco Packet Tracer Questionnaire:

1. Have you used Packet Tracer (PT) before 2014? Yes | No
   - Yes ☐ No ☐

2. Did you use PT before 2014 because I used PT for a lecture on a previous course in 2013 or earlier? Yes | No
   - Yes ☐ No ☐

3. I have used a network simulator/simulator before 2014? Yes | No
   - Yes ☐ No ☐

   (A network simulator such as Cisco Packet Tracer allows you to design network topology and simulate networking events and protocols)
   - Yes ☐ No ☐

4. I have used the following network simulator before 2014.

   (List the ones you used before 2014)

5. I own a PC display or have access to a dedicated PC display and have PT installed.
   - Yes ☐ No ☐

6. If you own a PC display or have access to a dedicated PC display and have PT installed, what version(s) of PT do you have installed?

   - [ ] 7.0
   - [ ] 7.1
   - [ ] 7.2
   - [ ] 7.3
   - [ ] 7.4
   - [ ] 7.5
   - [ ] 7.6
   - [ ] 7.7

7. On average, how often do you use PT on a weekly basis?

   - [ ] 5 times a week
   - [ ] 4 times a week
   - [ ] 3 times a week
   - [ ] 2 times a week
   - [ ] 1 time a week
   - [ ] 5 times a week
   - [ ] 4 times a week
   - [ ] 3 times a week
   - [ ] 2 times a week
   - [ ] 1 time a week

8. On average, how often do you use PT after the lab session on a weekly basis?

   - [ ] 5 times a week
   - [ ] 4 times a week
   - [ ] 3 times a week
   - [ ] 2 times a week
   - [ ] 1 time a week
   - [ ] 5 times a week
   - [ ] 4 times a week
   - [ ] 3 times a week
   - [ ] 2 times a week
   - [ ] 1 time a week
Biographies

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Big Data, Audience Measurement and Digital Watermarking: A Review

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Abstract

The objective of this paper is to provide some background to those interested in big data, audience measurement and digital watermarking. These technologies are currently in trend and are linked together. Big data provides techniques for analysis of complex and large data produced by audience measurement: radio, TV, Internet, Newspaper, religious and Education while digital watermarking is useful in counting audience to produce accurate data. The paper uses exploratory technique to achieve its objectives. We discuss some introductory concepts on the three types of technologies and some alternative methods employed for each service and also proffer a way forward using digital watermarking for a solution. The paper concludes by looking at the usage of the technology in Africa present the way forward into the future.

Keywords: Big data, audience measurement, digital watermarking

Introduction

Big data, according to Wikipedia, is the term for a collection of data sets so large and complex that it becomes difficult to process using on-hand database management tools or traditional data processing applications while audience measurement, as the term is commonly used, refers to regular assessments of the size and composition of media audiences (Muller, 2001).

The interaction of connected consumer electronics and digital media is creating vast and limitless amounts of user data, now commonly coined "Big Data." Many new business models are forming around these data, but for advertising, data have always been at the core of its business. Data of all varieties and volumes enable stakeholders to invest proportionally to the value of their media assets; whether TV commercials, video programs, gaming apps, online publications or advertising messages (Way, 2014).

Big Data create new ways that stakeholders can measure the audience. Traditional targeting has long been audience-based using demographic, geographic and time-based information. However, user data originating from content consumed on an Internet-enabled device is much more granular in nature -- more data points are collected, supporting highly refined audience-targeting methods, including both audi-
ence-based and interest-based methods (Way, 2014). Audience-based data and targeting practices segment consumers based on who they are, the devices they use, and the media content they consume. Interest-based measures support techniques that pinpoint and engage consumers based on their interests and preference (Way, 2014).

Digital watermarking is a technology that embeds information, in machine-readable form, within the content of a digital media file (for example, a movie, song, or photograph). Digital watermarking is the process of embedding information into digital material in such a way that it is imperceptible to a human observer but easily detected by computer algorithm (Mooney & Keating, 2005; Seitz, 2005; Serra-Ruiz, & Fallahpour, 2010).

The accuracy of the data is very important to a good decision making. There is various method of collection of data. Digital watermarking can serve as a means of accurate data collection mechanism thus the link between the three technologies giving birth to the title of the paper.

We perceived a state of neglect to this aspect in most African countries with the exception of South Africa which has developed an audience measuring culture. In Nigeria and most of the African countries there has not been a deliberate structure on ground to measure audience except for individual companies relying on record of sales and some other form of marketing research. The closest to it is by monitoring the number of callers that called on a program but no dedicated peoplemeter or panel for any TV or radio. Also the popular webometric data for measuring how many people access institutional data is quite popular and is being used to rate universities here in Nigeria. But what other usage and analysis of the data generated from this measurement over a long period is quite unknown.

Therefore the objective of the paper is to bring to fore the relationship between the emerging technology of audiences measurement, big data and digital watermarking the various uses. This paper used an exploratory technique in its approach by studying works of other authors and exposing the need to embrace the subject matter in view of their importance to the society.

The Arab News (2014) reported the training of Lectures on big data and Analytics. They said the global demand for big data jobs is currently in the millions worldwide. This is between 1- 1.5 millions in the US alone. Institutions can set a rebuilt of their curriculum to the current trends. Part of the Saudi e-government vision is to digitize and automate all government transactions and correspondence across all ministries. This is predicted to generate more and more data which creates room for the adoption of big data technology.

**Literature Review**

**Concepts of Big Data**

**What is big data?**

Big data, according to Wikipedia, is the term for a collection of data sets so large and complex that it becomes difficult to process using on-hand database management tools or traditional data processing applications. Big data is a popular term used to describe the exponential growth and availability of data, both structured and unstructured (SAS Institute, 2014). Big data may become important to business and society such as the internet is today. This is because more data may lead to more accurate analysis.
Big data analytics

Big data analytics is the process of examining large amount of data of a variety (big data) to uncover hidden patterns, unknown correlation and other useful information. Big data technologies: NoSQL databases, Hadop, and MapReduce.

The definition of big data can be done using three Vs: volume, velocity, and variety

**Volume:** Many factors contributed to increase in volume:
- Transaction based data stored through the years.
- Unstructured data streaming in from social media.
- Increasing amount of sensors and machine-to-machine data being collected.

**Velocity:** Data is streaming at unprecedented speed and must be dealt with in timely manner. RFID tags and smart metering are driving the need to deal with data in near real-time.

**Variety:** Today’s data come in all formats: structured, numeric data in traditional databases, unstructured text documents, email, video, audio stock ticker data, and financial transactions (SAS, 2014).

Other dimensions of big data are:

**Variability:** Data flow can be highly inconsistence with periodic peaks

**Complexity:** Today’s data comes from multiple sources. It is important to link sources, match cleanse and transform data across systems. It is also necessary to connect and correlate relationships hierarchies and multiple data linkages or data can spiral out of control.

**Benefits of big data**

The issue is not collecting large amount of data. It is what you do with it that matters. Organisation should be able to take data and analyse to find answers that produce cost reduction, time reductions, new product development, and smart business decision making. Combining big data and high powered analytics, it is possible to:

- Determine root cause of failure, issues defects in real-time, potentially save billions of dollars annually.
- Send tailored recommendations to mobile devices while customers are in the right area to take advantage of offers.
- Quickly identify customer who matter most.
- Use clickstream analyses and data mining to detect fraudulent behaviour.
- Generate retail coupons at the point of sale based on the customers’ current and past purchases.
- Optimise routes for thousands of delivery packages while they are on the road, e.g., UPS.

**Big data in action**

**United Parcel Services (UPS)**

UPS stated capturing data and track variety of transaction in the 1980. They now track data on 16.3 million packages per day for 8.8 million customers, with an average of 39.5 million tracking request by customers. The company stores 16 petabyte of data.
Sloan Digital Sky survey (SDSS)
The Sloan Digital Sky Survey (www.sdss.com) is the most ambitious astronomical survey ever taken. It started collecting data in 2000. It has collected in a few weeks’ data more than all data collected in history of astronomy. At the rate of 200GB per night they have amassed 140 terabytes of information (“Sloan Digital Sky Survey,” n.d.).

DNA
Decoding of human genome originally took 10 years to process, now it can be achieved in less than a week.

NASA
The centre for climate simulation (NCCS) stores 32 petabytes of climate observation on the Discover supercomputing cluster.

US Government
In 2012, the Obama administration announces Big Data Research and Development Initiative, which explore how big data could be used to address important problem faced by government. Big data analysis played a role in Obama’s successful 2012 re-election campaign. US government owns six of the ten the most of the powerful supercomputers in the world (Hoover, 2012; “How bid data...,” 2013; Kalil, 2012)

Big data software
- Hadoop- Apache Foundation
- MongoDB- MongoDB Inc
- Splunk- Splunk Inc. etc.

Concepts of Audience Measurement
Audience measurement refers to regular assessments of the size and composition of media audiences (Muller, 2001). The concept of audience measurement stated as far back as the 1930 in America when readership of newspaper matters to the distribution and till the present internet era. This was pioneered by Nielsen Inc. In the era of digital broadcasting and with many new ways of watching TV content, accurate audience measurement has become more difficult. Audience Measurement services must now report more accurately and reliably from a larger number of channels, delivered through a fast-changing and diverse mix of broadcast platforms, and consumed either in real time or time-shifted mode.

Audience-based data and targeting practices segment consumers based on who they are, the devices they use, and the media content they consume. Interest-based measures support techniques that pinpoint and engage consumers based on their interests and preference (Way, 2014).

Uses of audience measurement
The major impetus for audience measurement is advertising. By the late nineteenth century most newspapers and mass circulation magazines had begun to sell space to advertisers. The value of space was determined largely by the number of readers who would see each publication, and by extension each ad. Paid circulation served as a reasonable surrogate for the size of the readership (Muller, 2001).

Today, advertising is a multi-billion dollar business. Audiences are bought and sold like commodities. Advertising expenditures are typically guided by audience measurement and the cost of
reaching various audience segments. In a business world increasingly interested in target marketing, research firms have been called upon to produce ever finer demographic distinctions, as well as data on lifestyles and product purchases.

The fact that advertising is the major source of revenue for several forms of media (including broadcasting, newspapers, and magazines) has embedded audience measurement in the operation of these industries. Obviously, the system places a premium on audiences that will be attractive to advertisers, either by virtue of their sheer size or desirable composition. Content, therefore, is evaluated with an eye toward its audience-making potential (Muller, 2001).

**Sources of error in audience measurement**

There are four sources of error in audience measurement: sampling, non response, response, and processing. The first three are, again, problems commonly associated with survey research. The last includes a variety of issues that have to do with bringing a saleable research product to market (Muller, 2001).

**Concepts of digital watermarking**

Digital watermarking is the process of embedding information into digital material in such a way that it is imperceptible to a human observer but easily detected by computer algorithm (Megías, Serra-Ruiz, & Fallahpour, 2010; Seitz, 2005). A digital watermark is a transparent, invisible information pattern that is inserted into a suitable component of the data source by using a specific computer algorithm (Katzenbeisser & Petitcolas, 2000; Petitcolas, Anderson, & Kuhn, 1999). Digital watermarks are signals added to digital data (audio, video, or still images) that can be detected or extracted later to make an assertion about the data.

**Benefits of digital watermarking for audience measurement**

- Accuracy and detailed detection logs allows the reporting of the content being watch, channel, airing time and distribution network.
- Can be used for radio, television, internet video and podcast audience measurement applications.
- ID tags or payloads enable transmission of significant amounts of data, providing superior audience granularity.
- Can be integrated into legacy audiomter to minimize change for panellists and audience operators.
- Allow improved live broadcast reporting as well as excellent time-shifted measurement.

**Methodology**

**Audience-Based Measurement and Platforms**

A number of factors such as transmitter power, local geography, station programming, wavelengths, and numerous other factors are known to influence the size of the audience (Bornman, 2008). Also, media consumers are not glued to one device, so an immediate concern is one of audience duplication, i.e., spending the time and money only to target the same user multiple times.

Despite industry demand, there has been difficulty developing a standard that accounts for the overlap of traditional media and new media. A true cross-platform measurement approach quantifies unduplicated reach across broadcast and cable TV, the Internet, and mobile apps and Web properties. However, perpetual device fragmentation, differing data collection methods and re-
porting metrics, and the lack of an industry-backed system to standardize the process stifle industry efforts (Way, 2014).

- **Circulation Figures:** Collected by newspaper and magazine producers, based on copies sold or through marketing agencies/providers. Supplies the numbers of newspapers/magazines sold for a given period within a given geographical area.

- **Focus Groups:** Predominantly film, and sometimes magazines, uses focus groups. A feature film will be produced. If there is some doubt as to the impact or audience for the film, it will be shown to selected consumers and they will be asked to complete a questionnaire. Based on the results of the questionnaire, the film may be modified, for example, a new ending created or further editing to speed action.

- **Ratings:** Nielsen Media Research Television Ratings represent the industry currency for television audience measurement in most developed countries. Rating numbers are the average audience rating or the percent tuned to a particular programme during the average minute. A TV rating only measures how many people had the opportunity to watch. Therefore, programmes that have the larger audience are, by definition, the most successful ones.

- **PeopleMeters:** PeopleMeters are TV top-top boxes with remote controls used by all members in the selected household, each with their own codes. The data is collected every fifteen minutes and sent daily, every night, via a telephone line, to Nielsen. Overnight ratings data is available every day. See Figure 1:

![PeopleMeter](Source: AGB Nielsen Media Research).

Nielsen has consequently embarked on one of the world’s most comprehensive approaches to channel detection. Where a broadcaster agrees to cooperate, Nielsen will take the initiative to place an invisible or inaudible signal in the channel’s video or audio stream to permit the measurement of the broadcasts. Even when no active code is embedded, digital broadcasts can be iden-
tified by taking the video or audio signatures collected by meters and matching them to a reference data base of all possible signatures. This combined methodology patented worldwide by Nielsen make the identification of channel-specific viewing possible within an analogue, digital or mixed analogue-digital environment possible even without the cooperation of operators (Bornman, 2008).

**Audience of Print Media: Newspapers and Magazines**

Similar to most other media industries, editors and organisations involved in the publication of newspapers and magazines operate in two markets. The first is the market for the selling of copies. With regard to this market, readership data provide editors and circulation departments with information on the relative “success” of the publication in attracting the size and profile of the audience aimed for.

The audience size of a newspaper or magazine is usually measured in terms of the average issue readership, that is, the number of different people that reads a particular issue averaged across issues (coverage). Here it is important to point out that each copy of a particular issue could potentially have several readers. It is, however, insufficient to categorise people either as readers or non-readers of a particular newspaper or magazine. It is also necessary to establish the regularity or frequency of their reading (frequency). Frequency is usually indicated by the probability of contact with a particular issue. In the absence of electronic metering devices for measuring readership, readership research is mostly dependent on more traditional research methodologies and techniques.

**Radio Audience**

The unique nature of the radio as a broadcast medium presents problems to audience research which are in many ways not only different to researching television audiences, but also make it relatively more complex and difficult. It is, in fact, the advantages of radio as a medium – the fact that the medium is mobile and allows people to go on with their daily activities instead of requiring everything to come to a standstill – that make it difficult to measure radio listening:

The following techniques are employed in measuring radio audiences.

- Surveys in which respondents are questioned with regard to what they usually listen to, when they usually listen and how often they listen to particular programmes, namely their radio listening habits.
- Diaries.
- Metering – Audio metering was introduced before its applications for television. However, the growth in radio mobility (e.g., the development of car radios, the explosion in the availability of small portables) and the rise of multi-set ownership led to the demise of these systems of radio metering.

**TV Audience Measurement**

Audience measurement in television viewership is intended to collect information on the audiences watching a specific television program at a particular time. To accurately measure TV audience, a panel of representative audiences must be selected judiciously so that it accurately represents the entire target audience group. However, it is hard to secure a proper number of target audiences due to the expensive and cumbersome installations of measurement equipments.

Lim et al. (2013) resolved this issue in panel selection by proposing a novel television audience measurement framework (Figure 2) using pervasive smart devices such as a smartphone. In the proposed framework, a short audio signal from a television set is recorded by a personal smart
device and is sent to an audio matching server for the identification of the television program shown by the television set. For effective identification, they propose an accurate audio matching algorithm based on spectral coherence and efficient implementation techniques that exploit the inherent parallelism in the algorithm (Lim, Choi, Nam, & Chang, 2013).

Internet Audience Measurement

The arrival of Internet was around 1990 and by 1994 consumers was not so familiar with the internet. Consumer’s closest experience was with the commercial online services, CompuServe, Prodigy, and the rapidly growing America Online. The Internet addressable email system was only just becoming available on some of these systems in the later part of 1994 (Coffey, 2001). The Prodigy service was the first of the "big three" online services to provide a workable Internet interface for its subscribers.

External audience measurement of the commercial online services was not in demand at the time. The online services had an excellent subscriber counting mechanism in the form of subscription accounts with which to keep track of their performance. Standard accounting and internal metrics met most of their measurement needs. A simple periodic survey was sufficient to gauge relative market share, and none but the curious were otherwise interested in the size and composition of each of the firm's audiences, principally because no third-party significant decisions were being made based on the estimates (Coffey, 2001).

By 1995, however, Prodigy had launched its web interface as had CompuServe and America Online. PC ownership and commercial online service subscriptions were rising rapidly, very well in large part to AOL's windows-based easy to use interface Technical advances were providing more and more people with easier access to the Internet. Investment began flowing into Internet companies, particularly in Silicon Valley, which fueled further growth and media coverage (Coffey, 2001).

Uses of Internet audience measurement

Internet audience measurement is used for three main purposes:

- Self-promotion. It is important for organizations to be able to make claims about the size and growth of their audiences or technologies. While internal records are very valuable,
they are often not audited for external use and it is difficult to compare the results with those of competitors (Coffey, 2001).

- To support advertising planning, buying, selling and posting. Organizations offering Internet media opportunities to advertisers or their agencies, use audience measurement data to help position and sell the inventory. This is the same role that television ratings, radio ratings, and magazine audience estimates play for their respective media. The planner uses ratings data to sort through the many different options available, to identify those that are better values for the target audience (Coffey, 2001).

- Strategic planning. The data are a treasure trove of information once properly mined. Knowing the patterns of consumer behavior, how consumers interact with a particular site or group of sites, can help site managers make decisions that improve the traffic flow and objective of the site tremendously.

**Methods of internet audience measurement**

There are three primary methods of Internet audience measurement in use today, with each having several variations. These are:

- Measurement from a sample of users who are metered (electronic measurement)
- Measurement from a sample of users who are surveyed (recall measurement)
- Measurement from analysis of server log files or their equivalents

Survey from a sampled user: These studies draw a sample of Internet users and then query the respondents through standard survey methods. This could be done through telephone, in-person, mailed, or web-based interviews. The advantages of this approach is that pertinent, definitive detail about individual users can be captured, such as age, sex, income, geography, and so on. The survey method for measuring a specific site's audience is frustrated by three factors.

- Over-claiming is a significant problem for very well known properties, as sites with very high brand awareness are often claimed when no actual usage took place.
- Social desirability (or undesirability) can have a powerful influence on claimed usage. Visitation to adult content sites, for example, will naturally be under-reported, especially when a live interviewer is involved.
- Since usage estimates will be based on recall, naturally occurring errors in memory will affect the results (Coffey, 2001).

**Proposed Audience Measurement using Digital Watermarking**

The Digital Watermarking Alliance describes the issue of audience measurement as follows (“Audience measurement, n.d.)

In this new media world of insatiable content consumption, audience measurement is becoming more and more critical. Beyond the hard numbers of how many people are accessing a program, understanding who is watching, how they engage with the content, when, where and through which media is essential for content providers, advertisers and broadcasters to better tailor their offerings and maximize impact. The proliferation of devices and networks for watching content, the multitude of ways to watch such content and the changing habits in viewing content, such as PVR and catch-up TV services, is making audience measurement far more complex than ever before. Audience Measure-
Digital watermarking is proposed as a solution to accurate data gathering. Digital watermarking embeds a unique identifier into media content while being distributed or prior to distribution, making content and corresponding broadcasters instantly identifiable. Using specialized software able to retrieve, analyze and report the data, digital watermarking allows the precise identification of content and broadcasters.

The technology works by inserting digital data, imperceptible to the human ear, into each program's audio track. The digital ID contains information about the channel that broadcast the program, the airing time and, if relevant, a content identifier. Audiometers installed in panellists’ homes read the data, collect the information and send them daily to a central database for processing and accurate reporting as shown in Figure 3.

![Figure: Proposed audience measurement by watermarking.](image)

The advantages of using digital watermarking are that it can be applied in radio, TV and internet audience measurement with less complexity in terms of hardware requirement. If blind embedding is used then the Program_ID can be extracted without reference to the original insertion at broadcast time. It can also allow for other side information embedding useful for program identification.

**Conclusion / Future**

Most African countries with the exception of South Africa have developed a model for audience measurement system. With the interaction of connected consumer electronics and digital media there is the creation of vast and limitless amounts of user data, now commonly coined "Big Data." Given benefits and potential in the advertising industry, government, educational and scientific application stakeholders need to develop smart ways to manage the Big Data in their audience metrics and other aspects of the economy. The development of a unified audience metric standard is a difficult but important goal, and stakeholders should strive to provide full transparency to users with respect to tracking data as well as opt-out mechanisms. The future work will be on the integration of audience measurement and big data into Nigeria educational system and E-governmental purposes.
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Biographies

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An Examination of ICT Spending and the Development of E-Skills in the Republic of Turkey

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Abstract

Turkey’s Information and Communication Technology (ICT) sector has made remarkable progress in the recent past according to various statistics. They have jumped 26 places on the Network Readiness Index, from 71st place in 2010 to 45th place in 2013. Their GDP has doubled over the past decade. Their progress is the direct result of a variety of initiatives and public projects in concert with both foreign and domestic investment. Turkey has invested billions of dollars into their ICT sector in order to improve hardware, software, telecommunication & IT infrastructure. This is all helping create a large demand for e-technology and e-skill in Turkey. This paper seeks to examine the effects of major spending initiatives (foreign vs. domestic investment) on GDP as well as the motives behind investment choices. There will be special emphasis regarding FATIH project – Turkey’s highest dollar ICT project. The paper will include a comparison of GDP to a variety of data sets from the last five years such as; foreign direct investment, investment of public Turkish Lira, investment in hardware etc. Furthermore, evidence found suggests that the largest public ICT project in Turkey –FATIH – which was a large scale investment in technology in schools – was likely more-economically motivated than educationally-motivated.

Keywords: ICT, GDP, IDI, NRI, Turkey, Socioeconomic development.

Introduction

Geography/Region

Turkey is strategically located at the intersection of Europe, the Middle East and Africa. It is bordered by 8 countries; Bulgaria, Greece, Georgia, Armenia, Iran, Iraq, Syria and the Azerbaijani exclave of Nakhchivan. It is also bordered by the Aegean Sea to the west, the Mediterranean Sea to the south, and the Black Sea to the north. Turkey’s location at the crossroads of Europe and Asia clearly makes it a country of geo-strategic importance when it comes to ICT. Overall, Europe boasts higher rankings in ICT than countries in Asia or Africa. It should be noted that Turkey is not currently a member of the EU, but is in accession negotiations to become a member country. Turkey has the best NRI ranking in comparison with all of its bordering countries. This shows that
the methods Turkey is employing to improve their ICT are much more successful than the efforts of other neighboring counties in their region.

**Population**

Turkey has a growing population of 76 million. An interesting fact about Turkey’s population is that it has one of the highest percentages of young people in the world (ages 15-24). Additionally, half of the population is under 30 (Turkish Statistical Institute). The ethnic groups which comprise the population are as follows; 70-75% Turkish, 18% Kurdish, 7-12% other minorities, according to a 2008 estimate (Central Intelligence Agency, 2014).

**Turkey’s Education System**

Turkey’s education system is predominantly public and centralized. Public schools are run by MoNE or the Ministry of National Education. In 2012, Turkey’s compulsory education system was extended from 8 to 12 years, because access to upper secondary education is expected to increase, according to the RCI & ERG International report (ERG & RTI International, 2013). Historically, Turkey has not been known to have the best quality of education in comparison to EU countries. Although they still have challenges ahead, it has been recognized that the overall quality of education in Turkey is improving. Investment in the educational system through ICT projects is a top priority for Turkey, as 4 of the top 10 biggest dollar public ICT projects were education-related.

**Economy**

There is no doubt that Turkey’s economy is growing, see Figure 1. According to the World Bank Group, Turkey’s GDP has increased over 100% from 2004 ($392.2 billion) to 2013 ($789.3 billion) and has the world’s 15th largest GDP. Compared with EU countries, Turkey boasts the 6th largest economy. Its major exports include apparel, foodstuffs, textiles, metal manufactures and transport equipment (World Factbook, 2014). A large part of the economy is also tourism. Turkey is also a member of the G-20. Employment has been steadily increasing at a rate of 3% annually.

According to the Turkish Statistical Institute, the Turkish economy has received over $123 billion of foreign direct investment over the past 10 years and was rated and 13th most attractive FDI destination in the world (A.T.Kearney, 2012; Turkish Statistical Institute, 2014).

**Turkey’s ICT Sector**

The current state of Turkey’s ICT sector can be exposed by examining two indices; the Network Readiness Index (NRI), and the ICT Development Index (IDI). The Network Readiness Index is composed of a collection of sub-indexes which evaluate the impact of information and communication between the years 2004-2012 (Deloitte, 2014).

The IDI examines information communication technologies (ICT’s) at the global level and benchmarks the ICT readiness and usage of various economies. The IDI ranks countries’ performance with regard to ICT infrastructure and uptake.
**Turkey & the IDI**

The overall trend of Turkey’s ranking on the IDI index seems to indicate that they are in fact falling behind with regards to ICT infrastructure and uptake when compared to other countries. If you cross-reference this with the NRI ratings (shown in Figure 2), it becomes clear that uptake (usage) seems to be Turkey’s weak point.

**Turkey & the NRI**

Figure 2 illustrates the rankings, over time, of the 4 sub-indexes which make up the NRI. It is easy to see from this chart that Turkey continues to improve in every sub-index year after year, with the exception of the ‘usage sub-index.’ The scores from the 4 sub-indexes aid in determining the overall NRI ranking. According to 2013’s Network Readiness Index, the republic of Turkey ascends 7 places to an overall rank of 45 from a rank of 52 in 2012.

Turkey has made significant improvements in its political and regulatory framework, business/innovation environment, and has improved in developing ICT infrastructure. Some of Turkey’s weaknesses include being a late-comer in regards to launching mobile broadband services in 2009 (International Telecommunication Union, 2013).

**NRI and GDP**

When cross-referencing sub-indexes of the NRI data with GDP, a picture of how Turkey is accomplishing results in the ICT sector starts to emerge. The correlation between GDP and the overall NRI ranking is $r=0.107$. This number tells us that as GDP increases, the NRI Index for Turkey should improve. Conversely, this number tells us that as ICT improves, so does GDP. This correlation is relatively weak, but there is a small sample size. This means that the data is easily affected by outliers. With additional years added to this analysis, I believe that we would see a stronger correlation.

The improved ranking of the business innovation & environment sub-index was likely due to the continued development of “technology development zones” as well as other concessions and laws Turkey has enacted to encourage businesses to develop ICT technologies within its borders. The improvement in the infrastructure and digital content sub-index was likely due to the large investments made by Turkish companies in infrastructure such as Vodafone & Turkcell.

**Turkey’s ICT Future & Goals**

According to a report from the Investment Support & Promotion Agency, Turkey is actively seeking investment to become one of the top 10 countries in e-transformation. To do this, the government set a number of ambitious goals for the ICT sector to be reached by 2023 (Investment Support & Promotion Agency, 2014). The main goal is to reach an ICT sector size of $160 million, a market growth of around 15% annually and a sector share of 8% GDP, up from 2.9 percent.

Other stated goals of the Republic of Turkey include:

- Reaching 30 million broadband subscribers
- Providing internet connection for 14 million houses at a speed of 1,000 Mbps
- Having 80 percent of the population computer literate
• Increasing the number of companies to 5,500; employees to 65,000; and exports in USD to 10 billion in TDZs (Technology Development Zones)*
• Increasing the R&D expenditure to GDP ratio to 3 percent from 0.85 percent

**Initiatives to Advance E-Technology and E-Skill**

The specific benchmarks listed in the previous section indicate that the Turkish government is very in tune with the current state of their ICT sector and has very precise goals for the future of ICT in Turkey. The following will describe various initiatives underway which Turkey hopes will turn their above-stated goals into realities.

**ICT Support Organizations**

There are 4 major government-supported organizations whose purpose is to support the ICT sector; the Ministry of Science, Industry & Technology, the Ministry of Transport, Maritime Affairs and Communication, The Scientific Research and Technological Research Council (TUBITAK), and the Information and Communication Technologies Authority (ICTA).

The Ministry of Science, Industry and Technology was founded in 2011 and its main purpose is to “promote scientific thinking and create a knowledge-based society.” (Deloitte, 2014) The Ministry of Transport, Maritime Affairs, and Communication has been around since 1939, much longer than the Ministry of Science. Their projects tend to be a little broader in scope. One of their most recent initiatives was the establishment of the internet improvement board. Their goal is to improve the use and safety of the internet in Turkey. TUBITAK was established in 1960. According to their website, Tubitak represents Turkey on international research activities and organizes publications, scholarships, and grants for work done in the scientific/technological fields. The ICTA is a regulatory agency established in January 2000. They create delegations, are a service provider of electronic certificates, and they also provide IT risk management services.

**Technology Development Zones**

Technology development zones (TDZ’s), briefly mentioned above as part of Turkey’s ICT goals, were put on Turkey’s agenda by the Prime Ministry State Planning Organization in 1989 (The Coordination Council for the Improvement of Investment Environment, 2009). Technology Development according to the Zones Law No.4691 are defined as: “Sites integrating academic, economic, and social structures at or near the campus of certain universities; advanced technology institutes; an R&D centers or institutes; or a Technopark involved in these same areas of work. They are sites where companies using advanced technology or companies with a new technological orientation, produce and develop technology or software by through the facilities provided by the organizations mentioned above. They are involved in activities which transform a technological innovation into a commercial product, method or service and by this means contribute to the development of the region.”

The objectives of TDZ’s include: produce technological know-how, develop innovations in products and production methods, enhance product quality or standards, commercialize technological know-how, support technology-intensive production and entrepreneurship, ensure the adaptation of small and medium scale enterprises to new and advanced technologies, create employment for people with research qualifications and provide the technological infrastructure for the acceleration of the inflow of foreign capital which will bring advanced technology into Turkey (The Coordination Council for the Improvement of Investment Environment, 2009).

“Companies within technology development zones are granted various supports and exemptions totaling 1.4 billion Turkish Lira” (Deloitte, 2014). Since the 1990’s, 36 Technology Development
Zones have been built and 14 more are under construction for a total of 2209 companies. Turkey currently has 129 ICT related research and development centers and is still building more.

**Law #5746**

Similar to technology development zones, law 5746 supports and encourages development of technology by encouraging the establishment of R&D centers which will assist the Turkish economy in becoming globally competitive through R&D and innovation via exemptions and government support. This law supports R&D centers for various industries, 13 of the total 142 are dedicated specifically to ICT.

**Seeking Foreign Investment**

Turkey is actively seeking foreign investment to support its growing ICT sector in order to reach its 2023 goals (Investment Support & Promotion Agency, 2014). There are a number of agencies, online brochures, websites, and reports etc. which aim to attract foreign investment for the promotion of ICT and e-technology in Turkey.

**E-Devlet Project**

The E-Devlet project is a project conducted by the Ministry of Transport, Maritime Affairs, and Communication. The goal of the project is to gather all state utilities and make them accessible on one site and to increase access to public services using ICT. Transitioning to the new electronic ID system is part of this project.

**FATIH Project**

The FATIH project (Today’s Zaman, 2012) is a government initiative which stands for ‘the Movement to increase Opportunities and Technology.’ The project aims to integrate state-of-the-art technology into Turkey’s public education system. The project was launched in 2012. Initiatives of the project includes distributing e-tablets to every student enrolled in grades 5-12, installing smart boards in every classroom and launching an e-learning or distance learning component. FATIH is expected to cost 3 billion Turkish Lira. The project, which was initially launched in secondary schools but will eventually reach all grade levels between 2011 and 2019, has five main components as laid out in the official FATIH website (Bakanlık, 2012):

- Providing Equipment and Software Substructure
- Providing Educational e-content and Management of e-content
- Effective Usage of the ICT in Teaching Programs
- In-service Training of the Teachers
- Conscious, Reliable, Manageable and Measurable ICT Usage

**ICT Spending Analysis**

With varying agendas for foreign and domestic funds, investigating the effects of these investments on GDP is the core investigation of this paper. After analyzing Figure 3, it is easy to see the visual relationship between foreign direct investment spent (FDI) on the ICT sector and GDP. The red and blue lines representing GDP and FDI appear to be somewhat correlated. If Turkey is successful at increasing their foreign direct investment for the ICT sector, the po-

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*Figure 3 is a line graph comparing FDI, GDP and ICT investments in Turkey from 2009 to 2012.*
potential effect it could have on GDP could be enormous. This is especially true when you consider that in 2012; only 1.02% of foreign direct investment was spent on the ICT sector (which amounts to $133 million USD).

According to the 2013 ICT Industry report, from 2010 through 2012, substantially more foreign direct investment inflows were used on the manufacture of computers, electronic-electrical and optical equipment and less on information and communication services. This indicates that directing funds towards the manufacture of hardware and equipment could have a relationship with GDP.

It is also quite clear from the chart above that the public fund Turkey is investing in the ICT sector clearly outpaces GDP growth. This seems to be an indication that the Turkish lira (TL) invested are not as efficiently invested as the foreign direct investment monies are, at least at this time. This leads to the logical question - what is Turkey spending its public funds on?

Figure 4, from the ICT Turkey Industry report, describes the top 10 public ICT projects in 2012, in Millions of TL. In 2012, the FATIH project clearly leads ICT related investments in all of Turkey’s public sector investments, costing 803 million TL and using up 32.4% of ICT sector investment in 2012. The data indicates that the public spending on the ICT sector did not have strong correlation with GDP between 2009 and 2012. This is confirmed by the following quote from the ERG & RTI 2013 report, “There is little evidence to be found internationally about the actual economic impact of other large-scale technology initiatives like FATIH, but a report from the Turkish Ministry of Development suggests that the impact of total investment in FATIH will not have a long term (2023) impact on GDP growth.” Although short term effects on GDP would not be expected by this type of initiative (FATIH) since it is an investment in Turkey’s future generations, it is interesting to note that experts in the field do not believe it will necessarily have a long term effect on GDP either. It is clear to see that public spending is not currently having a profound effect on GDP, so why is Turkey allocating so much of their public funds to FATIH? This will be investigated further in the following section (ERG & RTI International, 2013).

**FATIH’s Plan: A Means to What End?**

The FATIH project has been called ‘one of the world’s largest technology projects of its kind.’ It is clear from the data to the right that Turkey has made it a top priority when it comes to allocating ICT spending. This finding prompted further investigation into how the project is being conducted.

According to the ERG & RTI International report,

> “ …at least 63 thousand tablets were distributed to students and 84 thousand classrooms were equipped with interactive whiteboards (IWB) as part of initial distributions; the tablet procurement process is underway, and the authors expect considerable program deployment in the 2013-2014 school year for thousands of classrooms across the country.”

This brings us to the question of why did Turkey chose the distribution of whiteboards and tablets as its main focus of the FATIH project? According to the ERG & RTI 2013 report, economic transformation could be a key driver. Turkish manufacturers contributed significantly to the production of technologies deployed under FATIH. Turkish companies manufactured the whiteboards as well as hardware components of the tablets. Perhaps the government was looking more
for short term stimulus to the economy than long term effect on GDP with the FATIH project. Spending the money under the veil of educational improvement was probably an easier way to sell this form of stimulus spending to the public. While the implementation goals of FATIH are very clear, such as how many tablets and whiteboards they want distributed to “x” amount of students, the ultimate results they expect are not. While the ERG & IRT were creating their 2013 report, one official from MoNE (Ministry of Education) told ERG & IRT that some of their expected outcomes include the following; “more engaged learners, increased and improved collaboration between students, reduced text book costs, increased use of visual, auditory and kinesthetic learning methods including games and simulations; and more robust use of analytics.” What is interesting about this statement is that almost none of these expected outcomes are measurable, with the exception of reduced text book costs. This evidence shows that the FATIH project is most likely more economically motivated than educationally motivated (Hakan & Faruk, 2013).

While combing through the 100 page 2013 ICT Industry report for Turkey, the true purpose of the FATIH project is revealed, “The FATIH project in education is a mega-project that will support the hardware sector.” Figure 5 illustrates the increased spending. Out of all the literature encountered, this statement was the only indication that there was an agenda other than promoting the use of technology in the classroom, it seems that FATIH is not as much about the children as most of the government literature on the project leads one to believe.

Testing the relationship between spending on hardware (current demand) and GDP seemed to be the next logical step to see whether this spending to promote the hardware part of the ICT sector is justified based on past results. The correlation between IT spending on hardware (demand from Turkish citizens) and GDP between 2007 and 2012 was not as strong as expected, r=-0.012 suggests that IT spending on hardware has not had significant impact on GDP when examining historical data. This does not mean that Turkey is not heading in the right direction. Analysis from TUBISAD, the Turkish Informatics Industry Association, proposes that the hardware sub-sector constitutes more than two thirds of the IT market, excluding the communications sector. “LCDs and other audio-visual devices, telecom components, mobile phones and other communication equipment are expected to be the major sources of technology spending in Turkey,” according to the 2013 ICT Industry report (International Telecommunication Union, 2013).

**Conclusion**

Although historical evidence indicates that foreign monies were more efficiently spent than public (domestic) funds, this analysis found that most invested monies were actually being allocated for similar purposes. It seems that spending on hardware is expected to increase a faster pace than the actual historical data shows. This suggests that the FATIH project could be part of the government’s plan to help ramp up the hardware sub-sector in preparation for increased demand to come in the years 2013 through 2017. This is further supported by the relationship between foreign direct investment and GDP in the past, as the foreign direct investment funds at the period of analysis were used significantly more on the manufacture of hardware and equipment as opposed
ICT Spending and the Development of E-Skills

...to being spent on communication services. It turns out that despite the fact that public projects appeared to be centered on other initiatives – all projects lead back toward the hardware sector.

Opponents to the FATIH project who may think it is not an efficient allocation of public funds may want to consider that FATIH promotes and supports the hardware subsector of the economy, which is the biggest contributor to the ICT sector in Turkey. It will help grow and sustain demand for e-technology and e-skill once the sizeable younger generations begin to enter the marketplace. It may also have the other desired positive effects on other sectors, education for example, by increasing the engagement level of students and increasing performance against other nation’s students. The positive effect on education in Turkey could be profound if educators took the time to ensure the technologies were being utilized to its fullest extent. The Turkish government should continue on its path toward making Turkey an accessible place to conduct business, as Turkey’s location lends itself to be a strategic geographical and technological hub. This combined with continuing to involve domestic companies in contributing to laying the foundation of infrastructure needed to support the future demand is paramount. Thus far, Turkey has made remarkable progress in the development of E-skill and E-technology. Turkey should continue to see the relative improvement of their IDI and NRI rankings given the initiatives they have taken to improve the usage and uptake of new technology.

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Biographies

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SYNCOM, A Tool for Competence Management

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Abstract

This paper addresses the issue of competence management in companies in the branch of Technical Communication. The problems these companies deal with concerns lack of specific education, more complex products, and a rapid change in how technical information is produced. Due to the rapid change the companies also need to be proactive and steer towards a desired future state. A design of a tool, SYNCOM, for competence management in modern high technology companies is presented. The tool is developed during a process based in idealized design. SYNCOM constitutes of a group of systemic models and techniques for competence management and competence development that has been used in earlier projects. The SYNCOM Tool presented is a general tool aiming to be a model for organizations. Implementation of the tool will require adjustments and adaptation to the specific organizations. The SYNCOM Tool has not yet been tested as a tool in any organization. The systemic models and techniques for competence management and competence development have been tested with good results in earlier projects where they in form of prototypes have been tested and verified.

Keywords: Competence, competence management, competence management system, technical communication, idealized design

Introduction

Many companies of today are in a state of rapid changing due to technical development and other external influences. Due to these changes the companies are in need for competence development for their personnel or even personnel with completely different competence. For companies within the branch of Technical Communication this is even more pronounced. In Sweden as well as in some other countries there is also a lack of education for Technical Communicators.

The area of Technical Communication (TC) deals with production and use of documentation such as technical descriptions, user guides, installation guides, repair guides, and advanced interactive user manuals. TC can be prepared for technical devices, apparatus, and systems – from more simple devices to more complex systems with embedded sub-systems e.g. a lorry or a container dedicated for medical treatment (attendance) used for aid contribution in turbulent parts of the world.

There are several problems identified when working with Technical Communication, for example the increased complexity in the documentation demands a more structured way of working, the users of the documentation are disparate and may vary during the prod-
ucts life-cycle which demands a more elaborated requirements analysis, and as the tools for producing more than just text-based documentation are rapidly developed there also are a wish for more sophisticated TC containing animations and multimedia. To deal with the problems there is a need to allocate appropriate resources for the tasks. This means keeping track of the competences in the company, assign competence development when needed or recruit personnel with the competence needed.

With the intention to start up and bring the research on Technical Communication systems further, a research project called Technical Information Centre (TIC) was commenced in May, 2008 (Asproth et al, 2008). A posterior project was finished in January, 2014. The two TIC projects were a collaboration including Swedish Defense Material Administration (FMV), Mid Sweden University, and a number of companies that produce and manage Technical Communication. One of the aims of the project was to improve and streamline competence development and maintenance. Within the frame of the project a tool for competence management in modern high technology companies has been designed.

There exist many tools for management of competence within companies. Already in 1999 Dieng et al (1999) performed a survey of methods, techniques and tools aimed at managing corporate knowledge, analyzing problems and solutions related to construction of the corporate memory. An overview of 22 Competence Management systems and 18 learning management systems was made by Draganidis and Mentzas (2006). It defines competence management is the way in which organizations manage the competencies of the corporation, the groups and the individuals. It has the primary objective to define, and continuously maintain competencies, according to the objectives of the corporation. The Competence Management systems are more or less built to keep track of the competence in the company. It can be designed to consider the interaction between organizational and individual level competence and the role of technology in this process (Lindgren, 2004).

However, there is also a need for organizations to act proactive, to foresee changes in the environment and to steer the organization in a certain direction. The organizations competence profile is important in this case.

Hence, the aim of this paper is to present a design of a tool for competence management in modern high technology companies.

### Working Procedure

The SYNCOM tool is developed during a process based in idealized design (Ackoff, 1981, 2001). Idealized design (Ackoff, 1981) is a method or approach which is used for striving for an ideal condition. An idealized design includes the ideas and ideals by the designers. The designers are supposed to practice free thinking. The idealized design creates the potential for the designers to be free from restrictions and limitations.

An idealized design is a design of an ideal system from given prerequisites with technological feasibility and operational viability as the constraints, and the ability of learning and adapting the design in a rapid and effective way as the requirement. The design cannot be in contravention to any law of nature and it has to be viable if it should be realized (Ackoff, 2001).

The idealized design is an ultimate condition and it could never be reached. However, the design can be a goal for the ultimate condition and can contribute to unlimited advancements; “Aim for the sky and you’ll reach the ceiling”.

The result of an idealized design should be the best possible ideal system the designers and participants can imagine in the design process from current prerequisites, i.e. the design produced is not the ideal design for ever, it is an ideal design for now and it has to be continuous improved ac-
According to the changing environment and prerequisites. This continuous process of improving the design is strengthening the organization and the humans within it. A common discussion about the system and the possibility to have an influence on the future system is developing humans and organization and encourage new ideas and this is consequently enriching the design (Ackoff, 1981).

The idealized design consists of three parts and applied in this work they are:

- Formulation of a mission statement
- Specification of the organizations possibilities and needs for competence management stated by the designers.
- Design of a tool for competence management

The launching platform for the SYNCOM tool is methods and models concerning competence development which are grounded in a systemic holistic view. These holistic competence development methods and models constitute the ground for the SYNCOM tool.

In the SYNCOM tool Feasible Identified System Target (FIST) has been used. Every FIST is a concrete part of the idealized design which is possible to reach in a planned period. If there are several successive FISTs the idealized design is more possible to approach (see Figure 1). The FISTs guarantee the development step to be in the right direction and avoiding of deadlocks.

![Figure 1. Idealized design](image-url)
Launching Platform

The basis for SYNCOM constitutes of a group of systemic models and techniques for competence management and competence development (Figure 2). These models and techniques derive from earlier projects where they in form of prototypes have been tested and verified.

**Figure 2. SYNCOM and its theory base.**

**Syntegrity-4**

SYNTEGRITY-4 (S4) is a general model for competence and organization development in companies and other organizations (Holmberg, 2001). Syntegrity-4 is inspired of Stafford Beer’s Team Syntegrity (Beer, 1994).

The model is based on four synergetic parts: *Actors, Perspectives, Team Syntegrity and Systems perspective*. In SYNCOM we use the society model from Zetterberg “The Periodic Table of Social Reality” with six different categories of information managers (Zetterberg, 2013). These categories are ”Makers”, ”Keepers”, ”Brokers”, ”Takers”, ”Providers” and ”Procurers”. The *Makers* creates new knowledge. The *Keepers* are those who preserve the information for future use. The *Brokers* transfer knowledge to new people. The *Takers* are those who use the knowledge. The *Providers* are responsible for that the information is provided to those needing the information. The *Procurers* finally, are those deciding upon new development projects. All the categories most likely exist in companies but SYNCOM will make them visible and explicit.

**FIO: Framework for Intelligent Organizations**

The framework for intelligent organizations includes the following three models:

The model **Systemic control** (Espejo et al. 1996) emanates from the idea that there are objectives and control variables on three different logical levels in an organization. The three levels are operative (to create value for the organization), strategic (to create prerequisites for value creation), and normative.

**Viable Systems Model** (VSM) (Beer, 1979) is based on the principle that an organization is viable in the long run only if it contains a set of management functions with specific relations. The management functions in VSM are connected to operational, strategic and normative management respectively.

The model **Team Syntegrity** (Beer, 1994) is a structured way to create coherence and synergy in larger groups of individuals.

To create or to augment intelligent organizations, the following framework with four synergetic dimensions can be used:

**Activities: Policies, strategies.** This means for example to create profile and trust, objectives and guidelines and to develop core competence.
**Structure:** *Processes, systems.* This means for example transformation of the companies’ structure including organization of management and creation of new infrastructure.

**Behavior:** *Culture, Abilities.* This means for example development and empowerment.

**Identity/Vision:** This can mean a “paradigm shift”

To accomplish a development in an organization towards this framework the three models Systemic control, Viable Systems Model, and Team Syntegrity can be integrated and used. In fact, each of the models has a strong connection to one of the dimensions of the framework.

1. *Activity dimension.* Systemic control helps to distinguish between the three management levels in an organization and to keep control of steering variables at the three levels simultaneously.
2. *Structure dimension.* Viable Systems Model is a powerful tool to diagnose an organization so it can stay viable.
3. *Behavior dimension.* Team Syntegrity provides a tool for development of relations and interactions in an organization.

None of the three models are however limited to be used in only one of the dimensions but can be used for the whole framework.

**Competence Management Processes in Technical Companies**

New competence is created by individuals in the company. The challenge for technical companies is to transform this often hidden and not formalized competence to accessible organizational knowledge. The first step constitutes of the new knowledge that emerges from problem solving by individual staff members. Development of high technological products requires cross disciplinary teams. The individual’s tacit knowledge must be transferred to a form that firstly the team and outmost to the whole company. There is a need for a competence chain according to Figure 3. (Östlund, 2001)

![Figure 3. Competence process in TI-organization.](image)

**Systemic Methods for Competence Development**

In the project DCD (Double Competence Development) was noticed that systemic models, methods and approaches had a lot to contribute to the area of competence development. A number of guidelines and methods for competence development were developed within the project. The results are shortly listed here:

1. **Holistic Management – Guidelines for development of learning organizations**
   
   Example of relevant parts:
   
   - Structure: Roles in the organization, relations, flows of information
1. 
- Shared mental models: To transform individual learning to organizational learning
- Shared visions: A shared mental model of the future of the organization

2. **Establish participation: Organizational learning through coordinated actions**
   Design of a work process for continuous adaptation and change to support horizontal and vertical communication in an organization

3. **Holistic approach for competence development**
   Design of an approach for continuous competence development with help of a computerized information system

   TSI is a general model for competence development which embraces both people and the organization.

5. **HCD (Holistic Competence Development)**
   Influenced by Holistic Based Learning (HBL).

6. **Living Competence Development (LCD)**
   Measuring of competence in the company and evaluation of the effects of competence development efforts.

7. **Competence analysis with Requisite Dimensionality Model (RDM)**

**Talkactive Knowledge Gathering (TKG)**

SKI is a method for collecting knowledge. The first step is to create a covering and rich picture of the organization, the staff and the activities within the organization. Through interviews with all employees not only the individuals' competences are mapped but also structures and information flows within the company are mirrored.

**Tool Design**

The SYNCOM tool has been designed with help of the idealized design approach discussed above in section two. That process has in a first iteration resulted in a design with 16 main dimensions according to Figure 4. Those dimensions include more than one hundred individual design points. This is substantially a design according to the Requisite Dimensionality Model (Holmberg, 1994; Löfstedt, 2001). It is ultimately based on the concept of Requisite Dimensionality, i.e. the theoretical design rational of Warfield and Christakis (1987).

This means that the idealized design represents a very detailed and concrete description, on a conceptual level, of the system in focus. However, not every question can be answered even in a detailed design and no designer is perfect. Consequently, the resulting design will not be flawless. Hence, the most important property of any designed system, so even ours, is the faculty of learning and fast and smooth adaptation to new environmental conditions. With other words, it has to be geared toward continuous experimentation, development and adaptation. The design, with other words has to define a goal seeking system.
Figure 4, SYNCOM with the main dimensions of its design.

As an example, in the design the concrete value of one or several variables is expressed in the form:

“The SYNCOM will be developed with help of Open Source Tools, such as PHP and ECMA-scripts. There will also be open tools according to the SQL and XML standards for data handling and the R package for statistics”.

Or, as another example:

“The individual employee is the basic unit in the SYNCOM system”. “It is possible to aggregate the basic units into the different organizational levels of the actual company”. “It is possible to make a multidimensional aggregation if the company has some sort of matrix organization”.

Here it is not enough place to quote all design points. However, some of the more prominent properties of the design are:

From a user point of view, as SYNCOM is a tool supporting planning and development of corporate competence. It can, among other things, be used in the following tasks:

- Career planning.
- Support of career and salary discussions with superiors.
- Surveying and displaying of key competence in the company.
- Support of competence management (right person on right place at right moment).
- Support of strategy and business decisions.
- Support of competence planning and recruitment of new employees.

SYNCOM can present information in form of standardized reports, tables, and graphs. The focus is put on graphical presentations in this way helping the user to see patterns and hidden relations. Further, in most graphs there is a time dimension expressing past, present and future states. This feature helps in detecting trends and change patterns.
SYNCOM is designed according to the already well-established principles of Soft Computing (Zadeh, 1994). Under this general umbrella we find several techniques which are well suited for handling the frequent imperfections of real life situations. In short, with this design decision the system becomes fairly robust and stable.

Based on the concept of Dynamic Competence (Holmberg, 2001) SYNCOM uses relation maps according to Figure 5 in order to display the frequency and quality of an individual's (Figure 5.a) or a competence group's (Figure 5.b) competence related communication.

![Figure 5. Communication patterns with frequency (line pattern) and quality (line colour) on individual and group level.](image)

SYNCOM applies a system of user- and security levels in order to controlling the access to the information stored in the system. Each user organization can set those levels according to their own security and privacy policy.

There is an open user organization responsible for the continuous further development, adjustment, and refinement of SYNCOM. It is based on a collective development environment according to the principles of open source software (https://fsf.org/, http://opensource.org/). Ongoing development of SYNCOM is ensured through monitoring of research and development results within relevant fields.

SYNCOM is accessed with help of an ordinary web browser, primarily via computer but also via phone (Smartphone) or web plate. The application runs on the Internet or on a user's own Intranet.

Users should be able to register their reactions and requests directly into the system. Those data are used on a regular basis as input for refinement of SYNCOM.

**Implementation and Refinement**

The SYNCOM Tool has not yet, entirely or partially, been implemented and empirical tested in any organization. This is the next step and the result of such a realization and empirical test of SYNCOM would accordingly be used to refine the Tool. Ackoff claims that the completed idealized design should be possible to comment on amongst the stakeholders and these comments should, if possible, be incorporated in the design developed. This should therefore be the next
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step in the design process of the SYNCOM Tool. Experimental demo versions of SYNCON (http://www.C8labs.net/SYNCOM/demo) will be made available on Internet in the pace as they are developed.

For implementation in an organization, we recommend a step wise implementation of the SYNCOM Tool. The first step would be to proceed from one person and his network and the internal communication between members in one group. The SYNCOM Tool presented is a general tool aiming to be a model or source of inspiration for organizations. Implementation of the tool will require adjustments and adaptation to the specific organizations, i.e. every organization should from its specific prerequisites and goals modify the design of the SYNCOM Tool.

Conclusion

The SYNCOM Tool presented is a general tool aiming to be a model for organizations. Implementation of the tool will require adjustments and adaptation to the specific organizations. The SYNCOM Tool has not yet been tested, as a tool, in any organization. However, companies involved in the research projects we have work with the last years have contributed with input to the content of the tool. The systemic models and techniques for competence management and competence development have been tested with good results in earlier projects where they have been tested and verified. The prototype will in a next step as a general model be tested in some organizations. The organizations that will test the SYNCOM tool will be companies mainly working with Technical Communication.

References


## Biographies

**Viveca Asproth** received the Ph D degree in Informatics from Stockholm University. She is now professor in informatics at Mid Sweden University. She is also a member of the Risk and Crisis Centre at Mid Sweden University. Her main research interests include visualization, spatial systems, decision support, anticipation and fuzzy systems. In her current research she is focusing on inter-organizational issues. Viveca Asproth is also one of the initiators of GSS, an EU-funded development project aiming at effective handling of interregional crisis and emergence situations.

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ITIL adoption in South African: A Capability Maturity view

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Abstract

The purpose of this study was to understand the practice of IT Service Management through the lens of the Capability Maturity Model in South Africa. Specifically, the objective was to assess capability maturity level of Information Technology Infrastructure Library (ITIL) processes of incident, problem, change, release, and information security in the organization; and the capability level of each key process area of Process, Procedures and Activities; Management Commitment; People, Roles and Tools; Metrics, KPI’s and Reports; and Audits, TQM and Checks. The results indicate that change management received a higher capability maturity rating than the other processes, especially release and problem management. For each ITIL process, Management commitment and their involvement was regarded as the critical key process area. Further results indicate that knowledge creation and development of the people in each process was important so as to avoid vendor dependency.

Keywords: IT Infrastructure Library (ITIL), IT Service Management (ITSM) framework

Introduction

The task of managing IT infrastructure continues to grow more complex as businesses rely more and more on Information and Communication Technology (ICT). This has put pressure on organizations to deliver effective and efficient ICT services (Galup, Dattero, Quan, & Conger, 2007). In order to manage their IT effectively and efficiently, organizations are now adopting IT Service Management practices and standards such as the Information Technology Infrastructure Library (ITIL) which provides implementation guidance and a common language of communication (Bailley, Kandogan, Haber, & Maglio, 2007; Tan, Cater-Steel. & Toleman, 2009).

By adopting these standard practices, organizations are able to ensure that their “enterprise's IT sustains and extends the organization’s strategies and objectives” (IT Governance Institute, 2007; Posthumus & von Solms, 2005). The need for IT Governance in South Africa has been strongly emphasized by the South African Institute of Directors...
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(IOD) who view IT governance as a framework that supports the effective and efficient management of IT resources in order for a company to reach its strategic objectives (IT Governance Institute, 2009). Despite this emphasis, it is believed that although good IT governance practices are known and applied, it is not universal (IT Governance Institute, 2008). The actual number of organizations adopting ITIL is not yet known, and in South Africa specifically, it is still not clear to what degree IT governance is adopted by organizations; and if at all adopted, it is not clear to what degree IT project governance is guided by IT governance. This paper investigates the capability levels of the implemented ITIL, and the capability levels by category within each primary process at a South African insurance company.

THE IT Infrastructure Library (ITIL)

Organizations are increasingly becoming aware of the essential role of Information Technology (IT) within their organizations, and are under pressure to account for costs, and to manage risks associated with the ever increasing vulnerability of their IT infrastructure. To meet these challenges, organizations have turned to IT governance as the solution which in turn has highlighted the importance of IT service management (ITSM) - “the set of processes that detail best practices to enable and optimize IT services in order to satisfy business requirements and manage IT infrastructure both tactically and strategically” (Galup et al, 2007). ITSM has influenced numerous standards such as the British Standard BS 15000, the ISO 20000 standard as well as other vendor frameworks such as IBM’s Process Reference Model for IT (PRM-IT), the Control Objectives for IT (CobIT) and Microsoft’s Operating Framework (MOF). In order to manage, ITSM, the IT Infrastructure Library (ITIL) was proposed as the widely accepted best practice framework for IT service management (Addy, 2007; Clacy & Jennings, 2009; Gartner, 2010; Hochstein, Zanerkow, & Brenner, 2005). “ITIL is a top-down, business driven approach to the management of IT services that specifically addresses the strategic business value generated by the IT organization and the delivery of high quality IT services” (Winny, 2008). As a framework, it enables managers to document, audit, and improve their IT service management processes. ITIL consists of five processes namely incident, problem, change, release, information security as depicted in Table 1.

Table 1. ITIL processes

<table>
<thead>
<tr>
<th>Process</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Incident</td>
<td>A deviation for the (expected) standard operation of a system or a service responsible for providing continuity by restoring IT service operations to customers in the quickest way possible by whatever means necessary (Cater-Steel, Toleman, &amp; Tan, 2006; Sallé, 2004).</td>
</tr>
<tr>
<td>Problem</td>
<td>Undesirable conditions that have been defined and identified from one large incident or many incidents exhibiting common symptoms for which the cause is unknown and are managed so as to ensure that these types of incidents are prevented from happening or minimized from happening (Cater-Steel, Toleman, &amp; Tan, 2006; Sallé, 2004).</td>
</tr>
<tr>
<td>Change</td>
<td>A change is an action that results in a new status for one or more components of the IT infrastructure (Cater-Steel, Toleman &amp; Tan, 2006). The purpose of this process is to ensure that beneficial changes are made with minimum disruption to IT services using standardized methods and techniques (Cater-Steel, Toleman, &amp; Tan, 2006).</td>
</tr>
<tr>
<td>Release</td>
<td>The release process is a collection of hardware, software, documentation, processes or other components required to implement approved changes to IT services so as to ensure that only authorized and correct versions of software are made available for operation (Cater-Steel, Toleman, &amp; Tan, 2006; Sallé, 2004).</td>
</tr>
<tr>
<td>information security</td>
<td>The preservation of information confidentiality, integrity, and availability so as to ensure business continuity, to maintain legal compliance, and to achieve competitive edge (Saint-Germain, 2005).</td>
</tr>
</tbody>
</table>
The Capability Maturity Model Integrated (CMMI)

Many companies have experienced difficulties during implementation. For example, organizations have reported a lack of organizational guidance towards implementation; ITIL requires too much change in culture, and it is too focused on technology, toolsets and software; it is too high-level to implement; and the organization usually lacks experienced consultants in ITIL (Addy, 2007; Gartner, 2010). Translating these hurdles into critical success factors, would require senior management commitment, persistence and patience, a culture of continuous improvement, financial support, and metrics (Holub 2009).

The Capability Maturity Model Integrated (CMMI) has been adopted in this research to allow the assessment a company’s attainment of the Critical success factors and also as a guide for organizations in assessing and improving their implementation processes. CMMI is known for its ability to evaluate how efficient a company is in designing, manufacturing and delivering its technology products (Paulk, 1993). The evaluation starts with an appraisal of the “as is” technology process maturity and once this has been determined the CMMI framework provides a methodology that guides the companies engineers and processes owners in a step by step approach towards more mature processes (Carnige Mellon, 2006). CMMI creates a path for the organization to improve from ad hoc, immature processes to disciplined, mature processes with improved quality and effectiveness by ensuring organizations are able to plan, define, implement, benchmark and improve their service management processes (SEI, 2009; Williams, 2008). The CMMI capability levels consist of six levels as depicted in Table 2; numbered 0 to 5 and the maturity levels consist of five levels numbered 1 to 5. A capability level for a process area is obtained when the goals for that level are met. Within each of these maturity levels are Key Process Areas (KPA) which characterize that level, and for each KPA there are five definitions: goals, commitment, ability, measurement and verification (Williams, 2008).

Table 2. CMMI capability levels

<table>
<thead>
<tr>
<th>Level</th>
<th>Process</th>
<th>Description and goal</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Incomplete</td>
<td>Process is not performed or partially performed. No goals exist for this level.</td>
</tr>
<tr>
<td>1</td>
<td>Performed</td>
<td>Process is performed according to specific goals that supports and enables the work needed to provide services. The organization lacks the necessary processes to sustain service levels. The process needs to be institutionalized</td>
</tr>
<tr>
<td>2</td>
<td>Managed</td>
<td>A level 1 process that has basic infrastructure in place to support the process, is planned and executed in accordance to policy, employs skilled people who have adequate resources to produce controlled outputs, involves stakeholders, is monitored, controlled and reviewed.</td>
</tr>
<tr>
<td>3</td>
<td>Defined</td>
<td>A level 2 process that is customised to meet specific business needs and the procedures are defined more rigorously with inputs, entry criteria, activities, roles, measures, verification steps, outputs and exit criteria.</td>
</tr>
<tr>
<td>4</td>
<td>Quantitatively Managed</td>
<td>A level 3 process that is quantitatively managed for quality and process performance.</td>
</tr>
<tr>
<td>5</td>
<td>Optimising</td>
<td>A level 4 process that is improved based on an understanding of the common causes of variation inherent in the process.</td>
</tr>
</tbody>
</table>

Goals

The Goal KPA entails the analysis of how an organization does its work and includes the activities the organization has to perform so as to achieve internal or external objectives. According to SEI (2009) companies can focus on three critical areas to improve and achieve their internal or
external objectives: people who have the relevant skills, training, and motivation; procedures and methods defining the relationship of tasks or activities to be performed; and the tools and equipment required to execute the task.

**Commitment**

According to the IT Governance Institute (2008) for the governance of IT services to be effective, management commitment and executive involvement and sponsorship is critical and will enable higher maturity levels to be achieved. IT services can also receive the correct prioritization if business requirements and priorities are communicated. This also enables the business to better understand the significance of IT services and how they support the business and in contrast helps IT manager understand the impact of IT services on the business. The ITG advocate management commitment in the preparation of business cases, obtaining budgets and the monitoring and reporting of the benefits.

**Ability**

The ability to make the right decision quickly and execute them effectively is the trademark of a high performing organization IT Governance Institute (2007). To achieve this, organization need to have capable people whose roles have been defined and who have the tools to execute the tasks designated. The roles and responsibilities, specifically for management activities need to be clearly defined for a successful IT governance framework (IT Governance Institute, 2007). Each manager should be responsible and accountable and have activities and tools clearly allocated when designing a service or a process. ITIL software tools will facilitate the end-to-end and life-cycle view of IT services by integrating the recording of incidents with other processes such as change management and configuration management (Cater-Steel, 2009).

**Measurement**

Goals, metrics, key performance indicators and resulting reports can be used to monitor service improvement and to drive continual improvement. According to Institute IG (2009) goals and metrics affect attitude and behavior and argue that care should be taken to ensure goals and metrics that are selected to encourage positive attitudes and behaviors required to deliver the anticipated outcomes and expectations of the business. For example, level 4 capability maturity is achieved when a process is quantitatively managed using statistical and other quantitative methods (SEI, 2009).

**Verification**

The verification KPA involves the process of continuous quality management, auditing and performing rigorous checks. This is because the quality of a product or service is dependent on the quality of the process used to create it (Baker & Fisher, 2007). The quality of all contributing processes does not only generate high-quality products or services, higher customer satisfaction, but it also enables companies to reduce costs and execution times (Conti, 1993).

**ITIL AND CMMI**

This study intends to understand the practice of IT Service Management through the lens of the Capability Maturity Model in South Africa. Because IT service management are realized through ITIL processes, the ITIL processes (incident, problem, change, release, information security) formed part of the research framework; and to determine the capability levels for each ITIL process area, the Key Process Areas (KPA) was designed into the framework as depicted in Table 3. That is, for each ITIL process, for example, Incident process, all the KPA (Process, Procedures &
activities; Management Commitment; People, Roles & Tools; Metrics, KPIs & reports; and Audits, Total Quality Management & Checks) were investigated.

Table 3. ITIL process and CMMI KPA

<table>
<thead>
<tr>
<th>Incident</th>
<th>Change</th>
<th>Problem</th>
<th>Release</th>
<th>Information Security</th>
</tr>
</thead>
<tbody>
<tr>
<td>Goals</td>
<td>Commitment</td>
<td>Ability</td>
<td>Measurement</td>
<td>Goals</td>
</tr>
</tbody>
</table>

Methodology

The research philosophy was exploratory and a combined approach of quantitative and qualitative research was used to gather data from a South African insurance company X. The company was chosen because it provided a contemporary real life situation and enabled an in depth treatment and analysis of the selected ITIL processes. Organization X has an extensive broker network and has been operating in South Africa for more than 50 years. Although the organization has a mature business network, a strategy shift has increased the requirement for new enterprise IT infrastructure and systems. The company has been implementing ITIL for more than 5 years, but not all of the processes have been fully implemented. The case study was cross sectional as it represents the state of the organization at a point in time. The study was conducted over a period of 5 months.

The sampling method was purposive and the source of the population came from the IT and Business department. The respondents were chosen because of the role in IT and the functions they performed within the process areas. The sample constituted of 41 people out of a target population of 66 and 5 process owners from the sample were interviewed after the assessment. The survey instrument based on the CMMI appraisal questionnaire adapted from the CMMI® for Services, Version 1.2 model and Standard CMMI® Appraisal Method for Process Improvement, Version 1.2: Method Definition (Cater-Steel et al., 2009) was used on a sample population within an insurance company to gather the quantitative data. A SCAMPI class B appraisal was used as this allowed for selected processes (incident, change, problem, release and information security management) to be appraised. Reliability statistics were carried out on the questions which resulted in alpha coefficient above .8. For each process, the Cronbach’s summary was: Incident = .987; Change = .982; Problem = .984; and Information Security = .987.

The participants in the study are directly involved in the process area that was examined. Several processes areas were examined and consistency was achieved across the process areas. The appraisals from each respondent were captured from the website into a Microsoft SQL Database. The online capture used validation techniques to ensure questions were answered correctly. The database tables where exported into separate spread sheets which were then collated into one master spread sheet with worksheets per process area. The statistical analysis was conducted with IBM SSPS version 19 and verification on the results was conducted by Statistics Solutions Inc. as shown in Figure 1. After the appraisal, unstructured interviews were conducted with the managers and process owners.

The objective of the interviews was to understand the overall process area; understand the history of the ITIL implementation and to gain extra information and insights into the process areas. The interview subjects were selected based on their role and involvement in service management within the organization. During the unstructured interviews, various forms of documentation supporting the organizations processes were examined to gain further insights and evidence.
Data Analysis and Results

**Capability Levels of the Primary ITIL Processes**

The results, in Figure 2 show that change management was highly praised whilst problem management received the lowest score with 1.24. Further analysis (ANOVA, Levene’s test and Bonferroni post hoc comparison) reveal significant differences between the release process and change management process subscale mean scores with a mean difference of -1.12 (p = .012). The change management was statistically higher than problem mean score. There were no significant findings between the other processes in the analysis. The mean difference of -1.12 (p = .012) can possibly be explained by the later adoption of the processes, i.e. incident and change were the main focus of the initial adoption in 2005, whilst problem and release have matured on the back of the early wins of incident and change management.
The interviews with the process owners revealed that the initial difficult point for the organization was the “help desk” and incident management process because these were the first processes to be implemented and the organization had no fully management support yet. They however indicated that the tangible results achieved with the initial help desk and incident management implementation facilitated further management commitment and sponsorship to introduce further ITIL service support processes of change and problem management. Although the process owner of the help desk was pleased with the tangible results, he indicated bitterly that the process was a vendor and consultant led process and as a result there was minimal learning done by the organization. This was discussed and addressed by all process managers. According to the incident manager, once the initial adoption of ITIL had matured and was at level 1 process, and after our staff, the manager and staff and the ITIL user community had become better trained, the knowledge enabled a transition from a tool / consultant / vendor led approach to a process led approach.

Release management received the second lowest capability ratings because according to the interviewee it had been on the backburner and managed by the software development team who made the process have a silo effect and less integration with release management processes. The process owner has noted that this is a problem which should be avoided in future implementation and indicated that the responsibility for the process will fall within the service management team and software development will just have inputs and outputs into the overall release management process. These future actions do provide evidence of an understanding of the gaps in the processes and that a process of incremental continual improvement exists. The process improvement plans are registered as projects and are being measured which is further evidence of the commitment of management and the process owners in improving the overall capability.

The managers for each process indicated jointly that training and knowledge acquisition allowed staff to realize that ITIL was not just a help desk process – that is awareness of what is going on, training and people development are important success factor in the acceleration of our ITIL implementation (Incident manager interview). There was clear evidence that certain individuals in the organizations were seen as the key champions on the ground in driving the adoption and maturation of ITIL process. The release of ITIL V3 has also stimulated all staff to have ITIL foundation training and there is a strong drive towards mentoring and coaching which is seen as a long term strategic knowledge creation

**CMMI Capability Levels in the Five Categories within Each Process Area**

For each ITIL Process, the capability level for each KPA was investigated (Figure 3).
Incident management

Incident management shows an overall CMMI Score of 2.06 with a standard deviation of .70; and the KPA within incident management scored between 1.66 (Audits, Total Quality Management, and Checks) and 2.30 (People, Roles, and Tools). The unstructured interview with the incident manager revealed that the service desk was the main driver for incident management adoption in 2005 and for most of us the initial impression of ITIL was that it was all about the help desk. The help desk has now transitioned into a service desk in ITIL terminology. The service desk does have a high turnover of staff and is sometimes referred to as temporary stock and it uses staff from other areas of the business and forms part of the empowerment strategy which does create re-training and people capability issues. To combat the issue of staff turnover, the service desk is made up of 1st level and 2nd level service desk analysts with the concept that the 1st level analysts are mentored and coached by the senior and more technically advanced 2nd level analysts. We designed this so that even though there is a staff turnover, the 2nd level analysts are there to pick up the slack.

Change management

The results showed that the change management ITIL process had the overall higher capability rating of 2.55, and management commitment was the highest KPA praised. Further analysis (Bonferroni post hoc comparison) indicates that metrics/KPIs/reports had a significantly lower mean score than the other KPA. The unstructured interview revealed that the change management team has been working together for 3 years and there is strong inter-communication with other departments and process areas which explains a higher level of integration. It is also apparent from the unstructured interview that the team is passionate about their role and understands the critical importance of their roles and responsibilities. The attitude and approach is also very positive and the implication is that the capability of change management will likely improve very quickly. The benefit of benchmarking a process is that it also shows where calibration and improve is required and small actions can improve the capability to a level 3 capability.

Problem management

Problem management process findings indicate an overall CMMI Score of 1.24 with a standard deviation of .75. The KPA scored between 1.05 and 1.46. Further analysis showed that there were no significant differences in the KPA's management commitment, people/roles/tools, process/procedures/activity, metrics/KPIs/reports, and audits/TQM/checks.

Release management

The release management process scored a CMMI capability level of 1.43 with a standard deviation of 0.7; and the KPA's scored between 1.06 and 1.75. A Bonferroni post hoc comparison revealed that the metrics, KPIs and reports (1.06, .69); and the Audits, TQM, and checks KPA (1.17, .70) had a significantly lower mean score than management commitment (1.62, .87), people, roles, tools (1.57, .62) and process, procedures, activity (1.75, .74)KPA.

Information security management

The finding for the information security management process is an overall CMMI Score of 2.14 with a standard deviation of .54. Using the Bonferroni post hoc comparison, the KPA's scored between 1.82 and 2.62; with people/roles/tools having a significantly lower mean score of 1.82, .69 than the audits/TQM/checks at 2.29, .56. The unstructured interview with the security manager revealed that information security has become a “hot topic” and the organisation is under compliance pressures, particularly in the requirements for data privacy. He indicated that the primary driver for this is corporate and IT governance and the organisation has established 2 year
data privacy compliance plan and is looking to implement ISO 27002 Information Security framework. As a result, the information security management was allocated further budget to assess the gap in information security processes and to improve the processes. There is also a drive to define the requirements and processes before implementing the toolsets, but we are starting to engage vendors to look at the different information security toolsets. We can therefore expect information security management capability levels to improve over the next 24 months as the processes are improved and integrated with other process areas. Another comment from the security manager was that the compliance requirement has not only increased management commitment, but management involvement in meetings, process reviews and communication has increased dramatically. This commitment, he indicated, has had a significant impact on the teams overall attitude and the individuals in the teams commitment. Training and awareness programmes have also been implemented and the organization is looking at organizational training plan to ensure awareness of information security

Discussion

The results indicate a strong dependency on people to adequately perform their duties, that management commitment and involvement is critical and that knowledge creation and development of the people is important. It was evident that there was serious focus on the service desk by organization X. These findings are not new because Hochstein et al (2005) and Cater-Steel (2009) noted that most organizations initial focus tend to be on the service desk and incident management as a “quick win” so as to obtain tangible results which strategically enabled the IT organization and process owners to obtain continued commitment, budget for training and personnel development.

Change management was also a central issue for the organization when ITIL was adopted. Within this ITIL process, Management commitment was identified as the critical KPA. The interviews indicated that senior management commitment during the initial phases was very high and communication, briefings and the intranet where used to keep all stakeholders informed, this is despite the drive over the last 18 month to reduce cost and internal communication. The significant importance of management commitment is highly supported by Cater-Steel et al (2009) who indicated that continued senior management support is critical to the success of any major IT initiative and that it needs to sustain and extend the organizations strategy.

Whilst the Change Management ITIL process showed a higher capability rating, release and problem management scored low capability levels. The first observation is that release management was unable to receive the adequate focus as it was under a different division, i.e. it fell under software development and release management was not seen as an infrastructure process, but rather as a software release process. However, with ITIL v3 and the re-training and certification there has been awareness that the infrastructure release process requires some focus.

Conclusion

This study used the CMMI appraisal methodology to measure the maturity of the ITIL processes using a case study of approach on a single South African insurance company. The research on the capability levels on the incident, change, problem, release and information security management processes revealed an overall CMMI capability rating of 1.81. The result revealed how the service desk and the development of the incident management process was the initial drivers for ITIL adoption and quick wins with tangible benefits were crucial to gain continued management commitment for the further implementation of ITIL processes. The report makes a contribution to the empirical examination of ITIL adoption, however more in depth analysis of all the ITIL processes are required and a longitudinal approach would be recommend with multiple companies.
The recommendation for future research would be to use a longitudinal case study approach across several companies to create more generalizable theory and to explore the wider context of ITIL adoption.

References


**Biographies**

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Motivating IT Staff in a Government Organisation in South Africa

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Abstract
Managing Information Technology (IT) staff to maximize productivity requires them to be motivated. The South African government has a poor reputation with regards to IT performance, and there is increasing pressure and criticism from the public to improve service delivery. The South African government is currently increasing its investment in IT with the aim of modernizing its legacy systems. This research investigated the motivation levels of IT staff in a government organisation. Motivation of Information Technology (IT) personal in government organisations particularly in a South African context has been under researched and served to provide an updated view of staff motivation in a parastatal. The approach used was similar to previous motivational studies of IT personnel. Both a Herzberg and a Job Characteristics Model questionnaire were used to measure staff motivating factors. The combined questionnaire was sent to government IT staff in a parastatal organisation. Twenty-nine completed questionnaires were returned and analysed.

Neither of the hypotheses, which had been based on the previous research findings, was supported. Firstly, the top Herzberg factors for the government IT employees were security of tenure and pay. The work itself, the top factor in previous research was, however, in the top 5. Secondly, the need to achieve Growth Need Strength (GNS) of IT staff did not match the Motivating Potential Score (MPS). Previous research identified a significant difference between the 2 factors with a very high GNS and a lower MPS for IT staff. In this research, surprisingly, the matching was reversed in that the MPS, the richness of the job, far exceeded the GNS, the individual’s need to accomplish. It appears that the job is too rich for the incumbent. This has major implications for IT management in parastatal organisations as this low level of congruence matching IT staff to jobs can lead to low productivity and poor motivation.

Keywords: Motivation, ICT staff, parastatal organisation, government organisation

Introduction
Managing IT personnel for maximum productivity is a major challenge as staff motivation is seen as difficult to manage (Muo, 2013). The South African government has a poor reputation with IT performance (Czernowalow, 2013), and there is increasing pressure and criticism
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from the public to improve service delivery (Harris, 2012).

According to Harris (2011), the South African government is increasing its investment in Information Technology (IT) with the aim of modernizing its legacy systems. Government expenditure on IT is growing at a faster rate than the private sector, specifically investing in IT infrastructure and accelerating e-government projects. By updating their legacy systems with new IT systems, government plans to try and lower costs and improve service delivery (Harris, 2012).

The South African government has a problem attracting and retaining IT staff with critical skills and this affects its capacity to deliver services. Retaining, developing and nurturing critical IT staff is a priority for most Chief Information Officers (CIO) (Stones, 2012). This is important for Government as the capacity of IT to meet service demand depends on the strength of its people. Douglas Cohen of the South African Government Association states “Technology on its own cannot achieve anything and must be supported by capable people and tested processes to provide services in which the public can have confidence” (Stones, 2012, p.3).

The objective of the study was to identify the factors that motivate parastatal IT personnel using the Herzberg and JDS instruments. Historically IT personnel in the government sector are a poorly researched area. Several motivation studies have been done previously in South Africa. These have typically used Herzberg’s Theory of Motivation and the Job Diagnostic Survey (JDS). This research used the same instruments to allow direct comparisons of IT staff working for non-government organizations and government organizations. The sample used in this research was based on a parastatal organization in South Africa. “A parastatal is defined as an organisation or agency owned, or controlled wholly or partly by the government” (Hayward, 2006, p.2).

**Literature Review**

Motivation is intangible yet its existence is accepted without question. It can be used synonymously with desire, want, need and drive (Couger & Zawacki, 1980, p.67). Early studies into the motivation of IT personnel have been dominated by Couger and Zawacki (1980) in the mid-seventies. Their studies found that IT personnel have a higher growth need than any other job category. In a South African study, a way to improve motivation and productivity through matching the job and the individual’s needs was concluded as being similar to IT staff worldwide (Couger & Smith, 1992a).

Since these early studies, the IT industry has developed dramatically and IT work has become more complex. IT staff turnover remains as a major problem within organisations (Mak and Sockel, 2001). “Stressors such as work overload and role ambiguity may result in an employee having low job satisfaction and motivation which may lead to low organisational commitment, burnout and high turnover” (Mak & Sockel, 2001). Due to an ever increasing demand for skilled IT professionals, it is relatively easy for them to move to new jobs as they have specialized skills which are expensive to replace (Ghapanchi & Aurum, 2011).

When workers are motivated by the tasks they perform and the organizational context, they experience greater satisfaction and are more likely to invest more effort into their work. This has a positive effect on performance and reduces absenteeism, time-wasting and staff turnover (Da Silva & Franca, 2012). Job characteristics defined by Hackman (1980), include the five core job dimensions of autonomy, skill variety, task significance, task identity and task feedback (Chen, 2008). Job characteristics have a big influence on employee satisfaction (Kim, 2009). When IT employees view the five core job dimensions favorably they have a greater sense of responsibility for their jobs and job outcomes (Chen, 2008). Previous IS research has found that IT personnel who view themselves as having a higher level of autonomy experience lower levels of overload and have more satisfaction from their jobs (Thatcher, Stepina, Goodman, & Treadway, 2006). Employees with more autonomy in their jobs have the freedom to decide how to structure their
work in ways they find more intrinsically motivating and experience greater satisfaction from task performance (Thatcher et al., 2006). IT workers have reported higher job satisfaction when they perform highly skilled, more meaningful work (Couger & Zawacki, 1980). When IT workers are able to use their many different skills they find their work more interesting and important and ultimately more intrinsically motivating (Thatcher et al., 2006).

Workplace characteristics are akin to what Herzberg termed ‘hygiene factors’ and include factors such as pay, company policies and supervisory satisfaction and influence work outcomes such as staff turnover (Thatcher et al., 2006; Hall, 2009). Role ambiguity and role conflict are often associated with staff turnover along with job autonomy and perceived workload (Ghapanchi & Aurum, 2011). “Salary, promotion and the perceived fairness of rewards are incentives that often have a determining factor in turnover decisions” (Ghapanchi & Aurum, 2011, p. 239). Organisations may neglect to create the proper work conditions to satisfy an employee’s needs resulting in employee turnover or low performance (McKnight, Phillips, & Hardgrave, 2004). Igbaria and Siegel (1992) distinguished between” task and organisation based rewards, proposing that both work and workplace attributes need to be taken into account (McKnight et al., 2004).

Thatcher (2006 et al.) found in his study of the relationship between intrinsic motivation and job characteristics that intrinsic motivation is separate from job satisfaction and that a positive relationship exists between job satisfaction and organisational commitment. Based on this finding it is important to “identify factors that motivate IT workers intrinsically” as that would positively influence job satisfaction and organisational commitment (Thatcher et al., 2006, p. 142).

Herzberg identified eleven factors that are significant to a worker’s motivation, six extrinsic (hygiene) and five intrinsic (motivators). Intrinsic factors which Herzberg calls motivators are factors to do with the job itself and include as an example recognition, achievement, responsibility, advancement and personal growth in competency. Extrinsic factors which Herzberg refers to as hygiene factors include for example factors external to the work such as company policies, management practice, working conditions and salary (Hackman & Oldham, 1976, p. 251). Herzberg’s theory states that workers perform their best and are most motivated when their work is rich in motivator (intrinsic) factors however if extrinsic factors are insufficient they may cause dissatisfaction. Motivating workers to perform their best cannot be accomplished by extrinsic factors alone (Hall, 2009).

The well-established Job Diagnostic Model (JDM) was developed by Hackman and Oldham (1976) and determines which job characteristics are important to an individual. The core job characteristics also referred to as the “five core dimensions” are defined as: skill variety, task identity, task significance, autonomy and feedback from the job. If these five core dimensions are present in a job they result in three psychological states: experienced meaningfulness, experienced responsibility and knowledge of results of their actions (Couger & Zawacki, 1980, p. 15). These psychological states will then result in high internal motivation (Hall, 2009) which motivates an individual to perform and continue to do well, to produce a high quality of work and to maintain those feelings of work satisfaction which will result in lower absenteeism and staff turnover (Couger & Zawacki, 1980). Figure 1 illustrates this model.
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Figure 1: Job Characteristics Model of Motivation (Couger and Smith, 1992)

Based on the model, a questionnaire is used which determines certain metrics for an individual based on questions using a 7-point Lickert score. These include Growth Need Strength (GNS) and Social Need Strength (SNS) for an individual as well as certain goal related, job satisfaction and feedback variables (Hall, 2009). GNS is a measure of an individual’s need to achieve, learn and grow beyond their current abilities, knowledge and skill level. SNS is a measure of the extent to which an individual needs to interact with other employees and Motivational Potential Score (MPS) is a measure of how the current job satisfies the needs of the employee (Couger & Smith, 1992a, 1992b). If there is a significant difference between an individual’s GNS and MPS score, they are likely to be dissatisfied with their current job situation. Previous research findings into IT staff motivation includes a Herzberg ranking of the ‘work itself’ as being the most important which validates the use of the Job Diagnostic Survey (JDS) as a significant means of measuring motivation issues. As shown in Figure 2, there should be an attempt to balance GNS and MPS.

Figure 2: MPS/ GNS Matchup (Couger and Smith, 1992)
Studies of public sector employees have differing views of what motivates them. Some studies propose that there is a higher purpose in working for the public sector and that the worth of an organization’s purpose can increase an individual’s motivation by increasing the importance of the job (Wright, 2007). He proposes that employees in government have a strong need to be of service to the public and offer a meaningful service (Buelens & Van den Broeck, 2007). Research has established that these employees are often less concerned with financial rewards and find it rewarding to be of service to others as compared to their private sector counterparts who are more motivated by direct economic benefits (Buelens & Van den Broeck, 2007; Wright, 2007). Monetary compensation is a key factor in determining job satisfaction and retention amongst private sector IT staff and on average private sector IT salaries are higher than that offered by government (Kim, 2009). Employees in the public sector have more of a work family balance than private sector employees as fewer working hours are reported (Buelens & Van den Broeck, 2007). Job stability and flexibility is cited as some of the strengths of working for government (Kim, 2009). The generally accepted belief is that “public sector employees are more intrinsically motivated” (Buelens & Van den Broeck, 2007, p. 66).

Opposing this view are studies that have reported problems associated with the public sector relating to job satisfaction (Wright & Davis, 2003). “Job satisfaction describes the feelings, attitudes or preferences of individuals regarding work” (Chen, 2008, p. 16). There are challenges faced by the public sector which may affect job satisfaction and IT staff retention. Of note are the working conditions in the public sector that differs from the private sector as there is a greater need for accountability, less integrated information systems and budgetary issues which prevents adoption of the most recent technologies and management practices. These issues along with staff mobility are a threat to IT staff retention (Reid, Riemenschneider, Allen, & Armstrong, 2008, p. 42). There are issues of low staff morale and inadequate investment in training and skill development. This has placed the public sector at a disservice when competing with the private sector for skilled labor (Wright & Davis, 2003).

The structure of public sector organisations and highly bureaucratic systems create conflict between purpose and structure, preventing public sector employees from reaching their full motivational potential (Wright & Davis, 2003). There is considerable disagreement in the research literature regarding the motivational aspects of government workers.

**Research Methodology**

The South African government has a problem retaining and attracting IT staff with the critical skills which affects its capacity to effectively deliver services. Nurturing, developing and retaining critical IT staff is a priority for most Chief Information Officers (CIOs) (Stones, 2012). This is important for the South African government too in order to meet service demands which highly depend on the strength of its people (Stones, 2012, p. 3).

The research followed a positivist, quantitative research approach. The objective of the research was to identify the factors that motivate the IT staff within the Parastatal concerned using the JDS developed by Couger and Zawacki (1980) and identify areas that need improvement.

Due to the disagreement mentioned in the previous section, this research has generated hypotheses that are the same as concluded in research for the non-government IT industry.

The following hypotheses were therefore derived from the literature review:

**H1** - The ‘work itself’ is the main motivator of parastatal IT personnel.

**H2** - There is a mismatch between GNS and MPS for parastatal IT personnel, whereby the GNS is greater than the MPS.
The Job Diagnostic Survey (JDS) was used to develop an online questionnaire that comprised of two parts: Herzberg’s instrument for measuring motivational factors and the Job Diagnostic Survey to evaluate the current state of jobs. The JDS is a well-established tool for measuring motivation and the reliability and validity has been verified and used widely amongst researchers for measuring motivation of IT personnel (Hall, 2009). The survey was sent with management permission to a target population of 120 IT personnel within a South African parastatal nationally. This included all IT personnel in the regional offices including Cape Town, Durban and Port Elizabeth as well as the Head office in Johannesburg. Non-probability sampling method was used as the sample size was insufficient for random sampling (Saunders, Lewis, & Thornhill, 2012). Convenience sampling was used as the target population was the most accessible to the researcher. The survey was conducted over a two and half week period to allow sufficient time for data analysis.

Thirty-three responses were received of which twenty-nine were completed questionnaires that were useable. The rest were incomplete and unusable. A large number of government recipients did not return their survey despite a major effort by the researcher. This study is therefore exploratory in nature as the data set is inadequate for many statistical techniques.

Data from the responses captured in Qualtrics, online survey software, was then exported into Microsoft Excel 2010 and Statistica for further analysis. Findings from the analysis are discussed in the following section.

**Findings and Interpretation**

The first part of the questionnaire Herzberg Motivational factors were ranked from the number one motivator to the least motivator at number eleven. The statistical mean was calculated and used to determine the highest to lowest ranking. The results are displayed in Table 1 along with a comparison from previous similar motivation studies of IT personnel conducted in South Africa. Conditions may have been different at the time the studies were conducted previously however the comparison serves to gauge whether ‘the work itself’ is still the number one motivating factor.

In this study, the parastatal IT staff ranked ‘job security’ as their number one motivating factor. Contrary to previous studies, the ‘work itself” was ranked at number 5 and ‘pay’ was ranked as the number two motivator. ‘Job security’ and ‘pay’ are both hygiene factors, were ranked at the top of Herzberg’s motivational factors.

This somewhat surprising result could be explained by current restructuring within the National IT to a centralised structure that happened recently resulting in feelings of uncertainty amongst IT staff regarding their current jobs resulting in ‘Job security’ as the number one ranking.

This finding did not support Hypothesis 1 that stated the ‘work itself’ is the main motivating factor of parastatal IT employees.
Table 1: Motivating Factors - Previous Research vs. Current Findings
(*intrinsic;**extrinsic)

<table>
<thead>
<tr>
<th>Herzberg’s Motivational Factors</th>
<th>1988 U.S.A (Couger)</th>
<th>1992 R.S.A (Smith)</th>
<th>2005 Cape Town (Humphreys)</th>
<th>Current Findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>*The Work itself</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>*Opportunity for achievement</td>
<td>2</td>
<td>4</td>
<td>5</td>
<td>8</td>
</tr>
<tr>
<td>*Opportunity for advancement</td>
<td>3</td>
<td>2</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>**Pay and benefits</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>*Recognition</td>
<td>5</td>
<td>5</td>
<td>6</td>
<td>7</td>
</tr>
<tr>
<td>*Increased responsibility</td>
<td>6</td>
<td>7</td>
<td>8</td>
<td>6</td>
</tr>
<tr>
<td>**Quality of supervision</td>
<td>7</td>
<td>8</td>
<td>9</td>
<td>10</td>
</tr>
<tr>
<td>**Interpersonal relations with peers</td>
<td>8</td>
<td>9</td>
<td>10</td>
<td>11</td>
</tr>
<tr>
<td>**Job security</td>
<td>9</td>
<td>6</td>
<td>4</td>
<td>1</td>
</tr>
<tr>
<td>**Working conditions</td>
<td>10</td>
<td>10</td>
<td>7</td>
<td>9</td>
</tr>
<tr>
<td>**Company policies</td>
<td>11</td>
<td>11</td>
<td>11</td>
<td>5</td>
</tr>
</tbody>
</table>

The Core Job Dimensions Compared

The questions in the second part of the questionnaire measure the five core job characteristics which create ideal work outputs. These job characteristics are Skill variety, Task identity, Task significance, Autonomy and Feedback from the job (Couger & Zawacki, 1980). Each of the five core job characteristics are constructs of several questions from the job diagnostic survey. All questions are measured on a scale of 1 to 7 with 1 being extremely dissatisfied and 7 being extremely satisfied. The constructs are calculated from the mean values of each question and averaged to form a single construct.

Table 2 compares the findings of this research with previous results. The same instruments as previous studies were used to allow direct comparisons of IT staff working for non-government organizations and government organizations.

In a comparison with previous studies done by Couger and Smith (1992) and others on the core job characteristics, notable differences were found for ‘Task identity’ and ‘Autonomy’ with the parastatal IT scoring significantly lower on both these measures. Following statistical analysis, the results were comparable with previous research.

Table 2: Core Job Characteristics - Previous research vs. Current findings
### Previous Research vs. Current Findings

<table>
<thead>
<tr>
<th>Core Job Dimensions</th>
<th>1992 R.S.A (Couger &amp; Smith)</th>
<th>Current Findings</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Systems Programmer</td>
<td>Manager</td>
</tr>
<tr>
<td>Skill Variety</td>
<td>5.65</td>
<td>5.72</td>
</tr>
<tr>
<td>Task Identity</td>
<td>5.22</td>
<td>5.42</td>
</tr>
<tr>
<td>Task Significance</td>
<td>6.08</td>
<td>6.12</td>
</tr>
<tr>
<td>Autonomy</td>
<td>5.38</td>
<td>5.48</td>
</tr>
<tr>
<td>Feedback from the job</td>
<td>5.16</td>
<td>4.94</td>
</tr>
</tbody>
</table>

When comparing Growth need strength (GNS) with Motivating potential score (MPS) according to job categories, a mismatch was found. Table 3 shows the results from the sample compared to previous research.

**Table 3: GNS vs. MPS - Previous Research vs. Current Findings**

<table>
<thead>
<tr>
<th>GNS vs. MPS</th>
<th>1992 R.S.A (Couger &amp; Smith)</th>
<th>Current Findings</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Systems Programmer</td>
<td>Middle Manager</td>
</tr>
<tr>
<td>Growth Need Strength</td>
<td>6.32</td>
<td>6.40</td>
</tr>
<tr>
<td>Motivating Potential Score</td>
<td>5.39</td>
<td>5.34</td>
</tr>
<tr>
<td>GNS /MPS mismatch</td>
<td>0.93</td>
<td>1.06</td>
</tr>
</tbody>
</table>

This is a startling finding as it differs significantly to previous findings. Whilst the richness of jobs (MPS) given to IT staff in government and non-government employees are fairly similar, the growth needs (GNS) of the staff to achieve is significantly lower for government staff as compared to previous studies. As the theory argues that the 2 indices should be matched as closely as possible to exert maximum motivation, there is a clear mismatch in this sample. In fact this is the opposite of previous research. The rich jobs far exceed the achievement needs of the IT employees.

Hypothesis 2 which proposed that the mismatch between GNS and MPS was correct except that the mismatch was in the opposite direction. Hypothesis 2 was therefore not supported.

**Conclusion**

Motivating IT personnel has been researched for many years. Currently there is a dire need to upgrade IT infrastructure and systems in South Africa and significant budgets have been allocated
for this purpose. Whilst IT staff is in short supply world-wide, there is a significant shortage in South Africa. Government find it difficult to recruit and retain IT staff. Part of retention of staff relates to how IT staff is motivated.

This research investigated the motivation levels of IT staff in a government organisation. As this type of organisation has been under researched previously this study served to provide an updated view of staff motivation in this context. The approach used was similar to previous motivational studies of IT personnel. Both Herzberg motivation factors and a Job Characteristics Model questionnaire were used to measure motivating factors. The combined questionnaire was sent to government IT staff in a parastatal organisation. Twenty-nine completed questionnaires were returned and analysed. This small sample means the interpretation should be treated with caution.

Neither of the hypotheses, which had been based on the research literature, was supported. H1 hypothesized that the ‘work itself’ is the main motivator of Parastatal IT personnel based on findings from previous research that ‘the work itself’ is the number one motivator of IT personnel. In the current study this was not the case and the ‘work itself’ was ranked at number 5 according to Herzberg’s motivation factors. Surprisingly, ‘Job security’ was ranked as the number one motivational factor for the IT staff of the Parastatal concerned. This could be attributed to restructuring within IT nationally of the parastatal organisation to a centralised structure creating feelings of uncertainty amongst staff regarding the security of their jobs. This highlights that prevailing conditions within an organisation can affect the outcome of motivational factor rankings and need to be considered when doing a cross sectional study of this nature.

H2 hypothesized that a mismatch exists between GNS and MPS for Parastatal IT whereby the growth need strength exceeds the motivational potential of the job. This was based on previous findings that IT personnel have a high growth need compared to other personal. Although in the current study it was established that a mismatch does exist between GNS of IT staff and MPS of the job, the matching was reversed. MPS, the richness of the job, far exceeded the GNS, the individual’s need to grow and accomplish. Although this study is limited in the generalizability of its findings, it has major implications for IT management in this organisation. As shown in Figure 2, in Cell 2 the level of congruence is low leading to the possibility of low productivity and poor motivation.

Practical Implications and limitations

This mismatch has likely lead to low motivation and poor productivity amongst IT staff. The practical implications of this is that job redesign is needed to better match individuals to their tasks and in so doing improve individual motivation levels. Further to this the management of the parastatal concerned should apply the Herzberg’s motivation rankings to gain a better understanding of what motivates their IT staff by analysing the top motivators. In this study, the top three motivators were ‘job security’, ‘pay and benefits’ and ‘opportunity for advancement’.

The limitations of this study were that the sample used was insufficient to generalise the findings. Although the research refers to motivation of IT staff in government organisations in South Africa the results cannot be generalised to all IT staff in all government organisations. More studies need to be conducted in parastatals in order to establish motivational norms of IT individuals.

References


Motivating IT Staff in a Government Organisation


**Biographies**

**Lisle Carolissen** is currently pursuing a Masters in Commerce Information Systems at the University of Cape Town. This is her first paper.

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Comparing Young Children and Teenagers as Partners in Co-Design of an Educational Technology Solution

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Abstract

This paper describes the design of a social media-based system aimed at providing after-school learning support to primary school children in South Africa. Through this system, teenage tutors will provide homework support to younger children who do not have access to such support. The design team consisted of six children aged nine and ten years, nine teenagers and two adults. During the design we aimed for as little adult interference as possible and rather allowed the teenagers to facilitate the sessions with the young design partners. Our idea was that combining teenagers and young children would yield richer results, helping us to overcome adult-child power relations and hence get more out of the young partners. We discuss and compare the design contributions made by the respective groups; we describe the difficulties and the positive outcomes when co-designing educational technology with children from two different age groups; and we make recommendations in this regard based on our experience. Results from the study showed that co-designing with partners from different age groups had both advantages and disadvantages related to age-specific preferences. However, if managed correctly, the variation in preferences could yield richer designs that are more successful on account of the diversity of design contributions.

Keywords: Participatory design, cooperative inquiry, educational technology, teenagers, young children.

Introduction

Reports in the literature on participatory design with children in South Africa are minimal in comparison to first world countries. Affordable computing options for homes and schools have led to children becoming the largest group of computer users in the world, including in some parts of Africa (Farrell & Isaacs, 2007; Madden et al., 2013; Winthrop & Smith, 2012). The use of mobile devices by children has also increased dramatically. Although there are still many areas in developing countries where poverty and lack of infrastructure prevent access to technology, many children in disadvantaged communities do have access to mobile technology (Mogotlane et al.,
Comparing Young Children and Teenagers in Co-Design

2010) through cellular networks. Internet access in South Africa is unfortunately still expensive and mobile phones in rural communities are rarely used to access the Internet. With prices dropping and access spreading, there is a future in sight where most parts of South Africa will have access to affordable (or possibly even free) broadband access (Barnard & Joss, 2012).

Social media applications are widely used by children for social interaction and sometimes for learning-related interaction. These media provide a potential platform where children can provide each other with learning support (Nerantzi & Beckingham, 2014; Winthrop & Smith, 2012). This is already happening informally and formally. Dr Math is one successful example of a tutoring system where university students help high school children with homework through MXit (Butgereit, 2007). Working from the assumption that children’s problems with reading and mathematics should be addressed as early as possible, we are developing a social media based tutoring system that will be suitable for children who are very early in their schooling careers, to receive assistance from teenagers.

Children are both cognitively and physically different from adults. The design and development of children’s products is generally done by adults. So, developing products for children that are both usable and engaging is hindered by designers as it is impossible for an adult to perceive the product through the eyes of a child (Burton, 2006). It is therefore crucial to include children in the design process. Since our system will simultaneously be used by teenage tutors and young tutees, we included children from both groups in our design team.

In this paper we investigate the different roles that children of two different age groups play in co-designing educational technology. The questions we ask are:

1. How do the outcomes of the design process with young children and teenagers compare?
2. How does the design behaviour of young children and teenagers compare?

Participatory design (PD), aims to help the designers develop user interfaces by actively engaging the end users. Involving children as much as possible in the design process initiates and facilitates innovations and improvements to the final design that might not otherwise have been thought of by adult designers. The principles of PD are the most suitable for design projects involving children as “their creativity and enthusiasm thrive within a flexible structure, and educational techniques have long stressed the benefits of mutual learning” (Nesset & Large, 2004, p. 144). The success of the participatory design activities and the increase in recognition of children as an important computer user group, has led to the involvement of children in the PD process.

**Participatory Design with Children**

Participatory design, in its simplest form, can be described as actively involving the stakeholders (most probably the users) in the design process (Benton et al., 2012; Druin 2002). The participatory design process involves the use of, for example, brainstorming and low-tech prototyping tools to capture and demonstrate the ideas of the participants.

For more than a decade, the growing market for children’s computing products and packages has compelled designers to involve children in PD to understand their issues and needs better (Druin, 2005). Cooperative inquiry (CI) has been developed as a technique to involve children in the design process (Druin, 2002). CI has its roots in a number of established fields, namely, cooperative design, participatory design and contextual inquiry. While these methodologies offer a good starting point for design, they need to be adapted to suit design teams that include children (Druin, 2002). CI aims to provide insights into that world in order to design the best products for children.
Burton (2006) states that “the world through the eyes of a child is a vastly different place to that of an adult and the only way to obtain this view is through the involvement of the children” (p.13). Children and adults have a different perspective of the world resulting in a difference in mental models. Burton believes that a good user interface helps the user develop the correct mental model that matches the conceptual model developed by the designers. To create a successful interface for children, an understanding of children’s mental models and thinking must first be established. This can only be done through the involvement of children in the design.

Common activities in PD and in CI in particular, include observation of the users and prototyping activities. Prototyping in CI involves visualising ideas through low fidelity prototyping techniques (Druin, 2002). It helps children communicate what they are imagining. The nature of the activity and the environment within which it is done should support the children and allow them to participate effectively. Low fidelity paper prototyping (Snyder, 2003) is highly visual and uses basic, familiar tools to design with. Children will be comfortable with this because most of them will have had exposure to using basic art supplies. Low fidelity prototyping in CI is sometimes referred to as bags of stuff—a technique in which children and adults are supplied with big bags filled with an assortment of art supplies such as glue, clay, string, markers, cork, and scissors from which to build their models (Guha, Druin, & Fails, 2013).

The majority of existing research on CI focuses on pre-school and primary school children, mostly between the ages of 4 and 11, leaving a gap in the literature on PD with teenagers. Fitton, Read, and Horton (2013) view teenagers as having the potential to be the best evaluators of technologies. They ascribe this to how teenagers relate to clothing, technologies and social media in ways that put them in a unique position compared to adults.

No examples of participatory interaction design with children in South Africa could be identified in the literature. Since technology is generally being introduced as a vehicle for solutions to problems in developing countries, such as inadequate education, children are often affected by the introduction of technology in these contexts (Roy et al., 2014). They should therefore be involved in the design of such solutions.

South Africa: Education and Technology

The Quality of Education in South Africa

Mathematics and literacy are key areas of child development and foundation phase education in South Africa. The skills required in these two areas are fundamental requirements for learning. Low levels of numeracy and literacy impact negatively on educational attainment and employment prospects, resulting in economic costs that are borne by the whole community (Chriswick, Lee, & Miller, 2003). The quality of education in South Africa is disappointing (Van der Berg, 2011). Surveys show that the level of cognitive achievement of many South African children is alarmingly low in key learning areas such as reading, mathematics and science (Seekoei, 2010).

The situation with respect to low educational achievement in South Africa has reached crisis level (Feza-Piyose, 2012; Fleisch, 2008). The Annual National Assessment report (ANA, 2011) attributes the alarming drop-out rate in high schools and problems in performance at tertiary level to a failure to get the basics right in the first few years of a child’s education. The pass rate has been between 46% and 47% (Feza-Piyose, 2012; Taylor, 2011). Over half of the pupils are performing at a level that indicates that they have clearly not achieved the competencies specified in the curriculum (Seekoei 2010). An assessment which included numeracy and literacy tests among foundation phase (grades 1 to 3) pupils attending government schools, showed that only 17% of the grade 3 pupils scored 50% and above in their numeracy assessment and 31% in their literacy assessment.
Several socio-economic factors lead to poor performance in literacy and numeracy. In South Africa, many young children are cared for at home by family members with low literacy levels who cannot provide the necessary support with homework and preparation for tests. Poverty also contributes to poor performance in schools. Poverty has devastating effects on children’s life chances of children, and nowhere is this more strongly felt than in schooling (Mji & Makgato, 2006 Taylor, 2011). There is also a huge shortage of teachers, especially teachers who can provide mother-tongue education to children who have English as a second or even third language. These and many other problems need to be addressed.

The Growing use of Mobile Technology in South African Education Systems

The potential of mobile technology is huge and it has broken ground for enhancing knowledge sharing activities among learners in schools (Hussein & Nassuora, 2011). There are increasing numbers of institutions of higher education in South Africa offering courses using mobile technologies as an alternative teaching and learning tool. According to Hussein and Nassuora (2011), regardless of such interests in mobile technologies in education, there is lack of academic research on the use of these technologies as a tool to support young children with their work, in or out of their school setting using social networking platforms. It is important to establish how these technologies can be incorporated into school and home settings for educational purposes.

If older children from privileged communities could be motivated to provide after-school learning support to younger children who do not have academic support at home, this could, in a small way, make up for the problems mentioned previously. Previous research has established that it is possible to find South African teenagers who are willing to act as tutors using social networking platforms (Chimbo & Gelderblom, 2012), to assist in homework and test preparations to lower-grade learners. Some of these older learners with access to mobile or computer technology are spending much of their time socialising with tools such as Facebook, Twitter and YouTube. An opportunity exists whereby the pervasiveness of mobile technology can be exploited to help with solving some of the problems in foundation-phase education in a developing-world learning context.

In our social media-based, cross-age tutoring system, teenagers would provide homework support to young children from disadvantaged communities. Young children who come from well-to-do homes usually have parents assisting them with their homework. In South Africa, many young children are cared for at home by siblings or family members with low literacy levels who cannot provide the necessary support with homework and preparation for tests. Having able children in higher grades helping those in lower grades would go a long way in bridging the support gap.

In designing our solution, we worked with teenagers from privileged schools in South Africa and young grade 3 and 4 children from a disadvantaged community.

Methodology

Overall Design Plan

The intended outcome of the design process is a social media based system that allows young children to request and receive online homework support from teenagers, without being exposed to any threats to their well-being. Our primary point of departure was that the application should as far as possible be designed by the end users – in this case, young children from disadvantaged communities and teenagers from privileged communities. Our plan was as follows:
1. Identify a community of underprivileged children where there is a need for homework support and where we would find young design partners.
2. Recruit teenage volunteers from privileged communities to join the design team.
3. For one month, take the teenagers to the children’s home to provide face-to-face homework support to the young partners to immerse them in the design context.
4. Conduct CI sessions with the teenage partners and with the young partners, where they provide input into the design of the proposed system.
5. Analyse the design data from the design sessions, build a prototype and return to partners for feedback and refinement.
6. Develop the solution, implement it in a pilot environment, test, refine, test, refine and finally deploy the resulting system more widely.

In this paper we focus on steps 3, 4 and partly 5.

**Participants**

The community of underprivileged children that we identified as appropriate for the design phase of this project is a privately run children’s home that has a branch in Pretoria, South Africa. The children in this home have mostly been placed there by the court of law, which means that many of them have been exposed to abuse or neglect. They attend public schools in Pretoria, and although they receive excellent care in the home, there is a need for individual after school homework support. With the help of the staff we selected 6 children in grade 3 or 4 (i.e. aged 9 or 10) as part of our design team – three boys and three girls. All of these children’s home language is Afrikaans. They do all understand English well, but only two were willing to communicate in English.

Both researchers have children in public high schools in privileged areas of Pretoria, so nine teenage participants were recruited by word of mouth. They are between the ages of 14 and 17 (in grade 9 or 10) and are all female. Four of them speak English as their home language while the others speak Afrikaans. Two of the English-speaking teenagers do not speak or understand Afrikaans but all the Afrikaans-speaking teenagers are fluent in English.

The language barriers were overcome by the correct pairing of the tutors and the tutees. Since one of the researchers does not understand Afrikaans, the second researcher acted as translator when necessary.

**Data Collection**

The data collected during this design project consisted of:

- Audio recorded individual feedback on face-to-face tutoring sessions, transcribed and translated into English by one of the researchers.
- Physical paper prototypes created by the teenage designers in groups.
- Physical paper prototypes created by the grade 3 and 4 designers in groups.
- Video recordings of the presentation of the designs produced by the teenagers (all these presentations were done in English) and audio recordings of the presentations by the younger designers.
- “Big ideas” recorded by the researchers while the groups of teenagers and young children presented their designs respectively (those presented in Afrikaans were translated into English by one of the researchers).

Below we provide a detailed description of how this data was collected.
Part 1: Face-to-face sessions
The first part of the data collection took place during the month of face-to-face tutoring sessions (step 4). For four weeks in September 2013, the researchers took turns to take tutors to the children’s home once or twice a week, depending on the availability of the teenagers. The number of teenagers that attended these sessions varied from one to five. This meant they were sometimes paired one-to-one, sometimes two-to-one, and sometimes one tutor would work with two groups of three tutees during one visit. During the sessions, the tutors would help the young children with their homework and test preparation. From the outset the researchers interfered as little as possible and allowed the teenagers to decide who to tutor, how many to work with at a time, what to cover in a session and how to go about it. At the end of each session, both the tutors and the tutees shared their experiences for the day through individual audio-recordings made either on digital audio recorders (provided by the researchers) or on mobile phones. These recordings were collected and later transcribed to form part of the data set to be used as input into the design.

Part 2: Participatory design sessions
The second part of the data collection involved participatory design sessions with the children. These took place in October 2013 at our university and at the children’s home respectively. We decided to conduct separate sessions with the two groups. The tutors had one three-hour design session whilst tutees had two 90 minute sessions on separate days. In the tutors’ session the researchers acted as facilitators, while the tutee design sessions were facilitated by some of the teenagers.

Tutors were divided into groups of three and asked to design and build/draw paper prototypes. We had prepared “bags of stuff” that included large sheets of paper, glue, sticky notes, stickers, colour pens, and more. Tutors were to reflect on their face-to-face tutoring experience and then translate those ideas into designing a system that could incorporate features of familiar social media (e.g. Skype, FaceBook and Twitter) but also completely new and innovative ideas. We used a combination of Muller’s PICTIVE approach (Muller, 1991) and paper prototyping (Snyder, 2003). The groups worked for about 45 minutes on their designs. The tutors, though in groups, decided each to put their own personal ideas down first then collate their ideas within the group. Past participatory design research confirms this approach to be successful – the participants must believe their ideas are important (Burton, 2006). Figure 1 shows the three groups at work.

After combining their ideas, each group presented their design. Following Guha, et al. (2013), throughout these presentations one of the researchers wrote all the “big ideas” that emerged on a white board (see Figure 2). These became part of the data set.

Figure 1: Teenagers brainstorming in groups
Figure 2: Big ideas recorded during teenagers’ presentations

Figure 3: One group presenting their design
Figure 3 shows a group presenting their design and Figure 4 is another example of a teenage group’s design.

Figure 4: A design prototype from a teenager group

As there was no restriction in our ethical clearance prohibiting us from using video recordings of the teenage participants, they were video-recorded whilst doing their presentations.

The tutees had their first session two weeks later so that some of the teenagers could help with facilitation. Four teenagers participated in the design sessions with the tutees which took place at the children’s home. The tutees have had limited exposure to technology, therefore the first session of 90 minutes was spent on familiarising them with the design content (i.e. mobile technology, tutoring and social media) as well as with the general concept of design. The children
“Skyped” individually with a research partner in the United States to convey the idea that distance is not a problem in communication and that you can have face-to-face interaction with someone who lives far away. We then let them build an obstacle course using the adult researchers and the teenagers as the building blocks (or obstacles). They had to guide a blindfolded partner through the obstacle course. The obstacle course activity was borrowed from the University of Maryland’s Kidsteam design team. The objective is to give the children exposure to the act of design while simultaneously breaking down the power relations between the different generations in the team. We were very successful on both counts, afterwards reflecting as a group on the overall design idea in preparation for the actual design session.

We started the second 90 minute design session at the home with a “question-of-the-day” (also borrowed from Kidsteam practice) where each participant received a chance to answer the question “What is meant by thinking out-of-the-box?” Their answers demonstrated that they understood the concept well with one tutee giving the definition “it is when you think of things that you never even knew you knew about”. In the design exercise that followed, the tutees were teamed up either one teenager with one child or one teenager with two children. They were provided with the same “bags of stuff” that we used in the teenage session before and created paper prototypes. The teenage facilitators were briefed beforehand to allow as much of the design ideas as possible to come from the younger partners. Through the activities of the first tutee design session it was made clear to the tutees that the process was informal and safe, and that they should feel free to air their views. After the session, the tutees reported back on their designs (e.g., Figure 5), and their “big ideas” were collected on paper by the researchers. The presentations were audio recorded only since our ethical clearance did not allow us to video record the young tutees.

![Figure 5: A design prototype from the tutees](image)

**Data Analysis and Results**

All data was analysed qualitatively. Through cycles of comparative analysis of transcripts of audio recordings; video recordings of presentations; recorded big ideas; and the physical attributes of the prototypes, we searched for elements that could potentially provide input into the design of the intended tutoring application. We paid special attention to the similarities and differences in the results of PD with the teenage partners and the younger designers.
**Results from the Audio Recordings**

The audio recordings yielded little in terms of design suggestions. The following design ideas could be extracted from the teenagers’ audio feedback:

- Tutoring should be one-on-one rather than one tutor working with more than one child at the same time.
- One should have other activities ready in case the tutees do not have specific homework or test preparation to do (e.g. teaching them French words or letting them read out loud).
- If the tutees need to be paired up they need to be friends because it would be difficult to work with two or more who do not get along.

The tutees’ recordings demonstrated overwhelming appreciation for the visits and the tutoring that they received. Their stories provided clear evidence that there was a great need for homework support and that getting this from teenagers would be very well received.

The teenagers were much more comfortable recording themselves than the tutees. It was clearly a novelty for the latter and they were reluctant to express opinions about the tutoring situation, other than expressing their love and appreciation.

**Results from the Design Sessions**

Seven themes emerged during analysis of the designs produced during the design sessions, namely High-level interface design; Communication mechanisms; Additional features and functionality; Rewards and motivation; Monitoring and evaluating tutee progress; Social media elements; and Psychological design issues.

**Comparing the design ideas of teenagers and young children**

The following results provide an answer to the first research question: How do the outcomes of the design process with young children and teenagers compare?

The following similarities and differences were noted between the design ideas produced by teenagers and young children, respectively:

**Differences.** Teenagers distinguished between a tutor view and a tutee view, while the young partners only designed a single view. Teenagers had many ideas and could describe the full functionality of their design. Young children had few ideas and none of them could give a coherent description of how the interaction would proceed.

Young children were more focused on decorative elements that users could add themselves, while this did not come up in the teenage designs. Two of the three groups of young partners mentioned the need to choose which language they wanted to communicate in, while this did not come up in the teenage designs.

Teenagers thought about practical issues such as their own time constraints.

Rewards suggested by teenagers were tangible in the sense that they would give the tutee access to some actual fun activities; the rewards suggested by tutees were symbolic rather than tangible (i.e. a flower or a chocolate that should appear on screen).

Both groups wanted a way for tutors and tutees to write on screen, the young designers suggested a “computer pen” and the teenagers suggested standard input devices (e.g. a mouse).

Teenagers put a lot of emphasis on recording the tutees’ progress and tailoring the interaction according to that. The young children showed a clear need for their own identity to be visible on their designs.
Comparing Young Children and Teenagers in Co-Design

**Similarities.** Neither group just wanted a Skype-like interface where they could talk synchronously. Both groups requested much more – access to games, progress reports, fun rewards, etcetera. Both groups saw the need for a login screen and password. Both thought of synchronous as well as asynchronous uses of the system and they all regarded access to games as essential. They also agreed that there should be some choice with respect to who the tutor and tutee would work with.

**Comparing the design behaviour of teenagers and young children**

Considering the second sub-question (How does the design behaviour of young children and teenagers compare?) we found the following:

**Aesthetics vs. functionality.** Our young partners placed more emphasis on decorative design, while teenagers preferred detailed designs that emphasized textual content (although there was attention to the aesthetics). The young designers were interested to see how they could use the materials provided on their design prototype without necessarily connecting it to the specific functionality of the tutoring system. The teenagers showed a combination of focus on aesthetics and functionality, with some taking it upon themselves to determine which features should be included and others putting this together using the materials given. In general, the teenage designs were more functional and the young designs more decorative.

**Creativity.** Although both groups wanted a way for tutors and tutees to write on screen, the young designers were more creative in this by suggesting a “computer pen” as opposed to the teenagers’ suggestion that writing could happen with standard input devices. Again, the younger designers were thinking out of the box, not afraid to try out new ideas, which would contribute to the innovativeness of the resulting designs. Further evidence that young designers found it easier to stray from what was practical was their suggestion for rewards in the form of symbolic gifts (e.g. an image of a flower or a chocolate that appears on screen).

The young designers asked for an interface that could be tailored according to their likes (e.g. placing their own pictures on it.).

**Attitude towards incentives.** The research shows that ideas for reward systems differ by age group. This finding will help designers to include appropriate incentive schemes based on the target age group for their designs. Related to incentive schemes is an understanding of what motivates different age groups to apply themselves at the highest level in any endeavour. While the teenagers suggested tangible rewards, such as the chance to play a game, the young children’s ideas showed that they expected much simpler rewards (e.g. a symbolic chocolate).

**Participation in groups.** There were clear differences in the children’s ability to work well in their small design groups. The teenagers were assigned to their groups by the researchers and accepted this readily. All three teenage groups worked together effectively and it was clear from their presentations that they all played equal parts in their respective designs. All group members of each of the groups contributed in the presentation.

The young groups struggled more and from reflections with the teenage facilitators afterwards it became clear that there was conflict between the young designers in both the groups that had more than one young member. These two groups did, however, produce more elaborate and useful designs than the group that consisted only of one young designer and one teenager. The boy in the latter group was very adamant that he did not want to work with any children and only with one specific teenager, which we conceded to. The presentations made by the young designers were also not as successful as those of the teenagers. In one group, the two children competed for speaking turns. The boy who designed alone with the teenager refused to present his design. The third group was successful in explaining their ideas, with some help from the teenage facilitator.
Conclusions

Creativity inherent in young children’s thinking yielded designs of user interfaces that were rich in decorative elements and graphical content as also noted by Nesset & Large (2004). Teenagers emphasized textual content elements in their designs, as opposed to decorative ones. Working with both groups showed that “children” cannot be regarded as a homogenous user group and that when a system is to be used by children from different age groups both groups must be accommodated in the design. Had we only designed with teenagers, we might have ended up with a system that looks good in terms of functionality, but lacked the decorative aspects that would attract younger users. On the other hand, had we only designed with young children we might have ended up with a decorative, aesthetically adaptable interface but with (possibly unsuitable) functionality determined by adult designers.

Teenagers displayed different attitudes towards incentives than what was observed with younger children, which means the reward system used in an application aimed at more than one age group should be considered very carefully and evaluated with the various user groups. In this design case, we might have designed an intricate reward scheme that involved scoring and access to games, where a mere electronic flower could have sufficed.

In agreement with Little et al. (2013) we found that co-designing with designers from different age groups has its challenges – the respective age groups will emphasize their own design preferences. However, if managed well, the diversity of preferences from the different age groups should result in designs that are richer on account of the diversity of design preferences of the different age groups.

Involving teenagers as facilitators in the design sessions with the young designers proved very successful. This was a key motivating factor in getting the young partners committed to the design task. Important in the success here was the fact the teenagers had their own design session prior to their facilitation role, and thus had a clear idea of how to proceed during the sessions with the young children.

Difficulties Encountered During Design

Because of the various extra-mural activities of the tutors and their different schedules at school, it was difficult to find suitable times to bring all of them together. So, during the preparation for design phases (i.e. the face-to-face tutoring sessions) we relied on their availability to determine who went to the children’s home. Sometimes only one tutor was available and had to split her tutoring time amongst the tutees, working with groups of three; and sometimes there were five tutors allowing for one-on-one tutoring. This logistical difficulty in getting teenagers to the tutees provides direct justification for developing an application that makes after school support available online.

Both the tutors and tutees had limited design experience. It takes time to become truly comfortable with the design process (Yip et al., 2013) and especially the younger children found it difficult to complete their prototypes in the available time. Ideally children must be given more opportunities to become comfortable with the methods and techniques of a design process. This applies to both age groups involved.

Language Barrier

As previously mentioned, there were some language barriers, but these are not an issue if you take care to overcome them. In this project they were handled through correct pairing of the tutors and the tutees. With regard to one of the researchers not understanding Afrikaans (the first language of all the tutees involved), the second researcher acted as translator. This added to the
overall research time and effort, but in a country where there are eleven official languages this is not a rare situation in research.

In summary: Teaming up young children with teenagers has clear positive outcomes, especially in terms of motivating the young partners to participate fully in design tasks. When teenagers are given the responsibility to design and facilitate it instills confidence in them and they will gain trust from the young children they are assisting. Young children bring to the design table an unrestricted imagination that does not necessarily provide crucial information about functional aspects of an application, but their ideas often shed light on what they would require in terms of interaction.

While our project provides an exciting opportunity for children to help develop a novel system that can greatly impact on children in less privileged communities, it also raises some difficulties regarding co-design. We have shown that some of the difficulties can be overcome by including both teenagers and young children in the design process: a wide range of design ideas are generated (from purely functional to purely decorative); young partners are better motivated to participate in design by the presence of teenagers; the young designers can learn from the teenagers about design; and the adult designers can use the teenagers as a communication channel to engage with the young partners, avoiding the inhibiting effect adult-child power relations may have on the young children.

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Biographies

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The Data Divide in a South African Rural Community: A Survey of Mobile Phone Use in Keiskammahoek

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Abstract

Recent research on cell-phone use in South Africa suggests rapid uptake of smartphones and increasing use of mobile data for accessing the Internet. Despite the significant decrease in the cost of mobile data, it is still unaffordable for the majority of South Africa's citizens, especially those living in extreme poverty in rural communities. In a recent piece on data pricing by cellular networks, Arthur Goldstuck of WorldWide Worx, argues that the "digital divide" is being replaced by the "data divide". This points to the emergence of networked activities as a significant aspect in mobile use across all socio-economic sectors. This paper discusses a survey of mobile use conducted in late June and early-July 2014 in Keiskammahoek, a rural area in the Eastern Cape Province which is characterised by endemic poverty and lack of services. The area is the site of the Makana Apps Factory, a project sponsored by the Eastern Cape e-Skills CoLab and hosted by Rhodes University's Department of Computer Science and School of Journalism and Media Studies. The study informed software development and training to improve the socio-economic conditions of the community. Of the 200 respondents, approximately 82% are unemployed. Drawing on the survey data and in-depth interviews, we explore inter alia how respondents are using mobile phones and for what purposes, what phones they are using, how and why phones are shared and how much money they spend. The survey suggests a strong interest for networked activities despite the relatively low socio-economic status of the participants. This is consistent with earlier surveys in Keiskammahoek and in comparable communities.

Keywords: digital divide, mobile data, rural areas, survey methodology, mobile apps.

Introduction

Recent research on mobile phone use in South Africa suggests rapid uptake of smartphones and increasing use of mobile data for accessing the Internet. A number of studies focus on mobile users (particularly the youth) in urban and peri-urban areas (Bosch, 2008; Butgereit, 2007; Francke & Weideman, 2007; Kreutzer, 2009). Although a vast portion of the South African population lives in rural areas, research on mobile access and use by members of marginalised rural communities is lacking.
In this paper we review past research conducted using survey methods in two comparable rural areas in the Eastern Cape Province of South Africa. We then present and discuss the findings of a recent survey in one of these areas. The novelty of our approach is threefold.

We focus primarily on uses requiring relatively advanced features. In a recent piece on data pricing by cellular networks, Arthur Goldstuck of WorldWide Worx, argues that the "digital divide" is being replaced by the "data divide". The same author notes that cost of data is becoming a significant problem in South Africa as more and more people become active participants online. While considering all aspects of mobile use, we feel that a focus on advanced features reflects a forward looking attitude, capturing current developments rather than reinforcing a view of rural dwellers as continuously excluded and backward.

We focus on two well researched case studies rather than aiming for a large and representative sample. Asking comparable questions over time gives us an insight into the dynamic dimension of the mobile phenomenon. The presence of research across disciplines and on various topics enables comparisons and a holistic understanding.

Our experience shows that employing established survey techniques in a rural area present specific challenges. After experimenting with various techniques, we propose a two steps approach involving the training of local fieldworkers to administer a questionnaire orally. While this strategy is not new, critical reflections on the application of such technique complement the findings of this study.

**Multiple Digital Divides in South Africa**

As access and use of technology becomes an important aspect of the daily lives of South Africans across the socio-economic spectrum, active participation in the information society required familiarity with the Internet. Within the current scenario, the most relevant aspect of the mobile phenomenon is the level of participation online, captured by the concept of the “data divide”. In this section we position the discussion on the data divide within a multiplicity of other divides, i.e. computers/mobiles, individual/shared, physical/epistemological and urban/rural. In all instances, we pay particular attention to the implications for access to and use of the Internet via mobile phones. Quantitative research documents the rapid uptake of ICT - and particularly mobile phones – on the African continent (Feldmann, 2003; ITU, 2013; Kruetzer, 2009; Rao, 2011). Numerous scholars (Dourando et al. 2007; Feldmann 2003; Ivatury & Pickens, 2006; Jidenma, 2013; Karanja, 2014; Skuse & Cousins, 2007) note the increasingly important role of mobile phones across domains and socio-economic sectors. The vast majority (up to 80%) of the phones in South Africa are expected to be smartphones by the end of 2014 (Jones, 2010).

Mobile telecommunicators provide services to low-income communities as part of their licencing requirements. In Sub-Saharan Africa, access is often limited by poor network coverage (Buys, Dasgupta, Thomas & Wheeler, 2009). The cost of data in South Africa has often been criticised as being too high (Abrahams & Goldstuck, 2012). A recent ruling by the Independent Communication Authority of South Africa (ICASA) – see aims at promoting competition and lowering prices by introducing asymmetric Mobile Termination Rates (MTRs – the extra charges to call users across different networks) in favour of smaller players. In order to save on Mobile Termination Rates (MTR) and cope with poor network coverage in certain areas, many people use more than one SIM card (see Chepken, Blake, & Marsden, 2013).

The most appropriate technology to support Africa's leapfrog into the information age is the object of current debate (Bramforth, 2011; infoDev, 2012). South Africa's ICT infrastructure is relatively advanced compared to the rest of Africa (Bovee, Voogt, & Meelissen, (2007). Through its Universal Service Agency, the South African Government is committed to providing universal access to ICT (Oyedemi, 2009). As in other African countries (see Mmusi, 2005), much effort has
gone towards community access via telecentres and schools. Goldstuck (2013) blames this approach for South Africa's drop in World ranking on Internet access and advocates in favour of household and individual access.

Donner and Gitau (2009), note that for a growing number of South Africans mobile phones are the first, if not the only, means to access the Internet. The fact that the mobile Internet is often prepaid, slow and expensive has implications on how these users experience being connected (Donner, 2008). A key difference compared to fixed-line uncapped broadband access is the issue of cost. All over Africa, as in other parts of the developing World, commercial as well as non-commercial phone sharing is practiced mainly as a strategy to cope with the cost of communication (Aker & Mbiti, 2010; James, 2011). Donner (2008) notes how sharing of ICT among family and friends contributes to reducing the digital divide in South Africa. In his study on mobile phone access and use by peri-urban youth in Cape Town, Kreutzer (2009) notes that phone owners and those who access shared phones display similarly high levels of use (up to 68% daily). He also notes the popularity of online news, instant messaging and the creative use of phones to take pictures and videos.

Due partly to past discriminatory policies and partly to current socio-economic inequalities and geographical configuration, access is profoundly unequal. Castells (2000; see also Donner, 2008) uses the term “fourth world” to refer to people across the gender, age, language, location literacy and other divides who, willingly or unwillingly, are at the periphery of the global network of networks. With specific reference to universal access, Goldstuck (2010) notes a lag between the achievement of physical access and active participation online. He terms this the Digital Participation Curve and quantifies it in roughly five years. That means that, even if everybody has access to the Internet by 2015, it will take until 2020 before everyone has the actual opportunity to meaningfully participate online. Besides issues of language, literacy and skills, attitudes also play a major role. The DPC concept links the dynamic dimension of physical access, exemplified by the rapid diffusion of mobile phones on the African continent with the realm of epistemological access. The distinction between physical and epistemological access is exemplified by the finding by Goldstuck (2010) that up to 60% of owners of Internet-enabled phones in a South African urban area are either unaware of or have never used this feature.

As noted by Odendaal, Duminy, and Saunders (2008) the urban/rural divide is a prominent characteristic of the debate around universal access in South Africa. Roodt, Paterson and Weir-Smith (2006) highlight the differences between different regions in South Africa and note that, while the relatively high Internet penetration is due mainly to concentration in metropolitan areas, the situation in rural areas is similar to the African average. Powell (2012) notes how the process of urbanisation brings more and more people within reach of large metropolitan networks. Rural areas can be considered not only representative of a vast and under-researched portion for the South African population, but as representative of many other realities on the continent.

**Research Context**

Our work builds on research in two comparable rural communities in the Eastern Cape Province of South Africa. The first one is located near the Dwesa nature reserve on the Wild Coast of the Transkei. Since 2006 the area is the site of the Siyakhula Living Lab, an ICT-for-development project initiated by the Telkom Centres of Excellence of Rhodes University and the University of Fort Hare. This case study is extensively documented in multi-disciplinary research (Cristoferi & Dalvit, 2013; Pade-Khene, Palmer, & Kayhav, 2010). For the purpose of the present paper, we refer particularly to two surveys of mobile phone and computer use among school children.

The first one (Gunzo & Dalvit, 2012) compares access and use in the rural area with a nearby small town township. The overall finding was that mobile phone use was twice as common as
computer use, while frequency was four to five times greater. Perhaps more significantly, the urban/rural divide was notable with respect to computer use, but not mobile phones. However, when networked activities such as email and Web browsing were concerned, youth in peri-urban areas seemed much more confident and experienced users. These findings highlight the intersection between the computer/mobile and the urban/rural divide.

The second study (Gunzo & Dalvit, 2014) represents a follow up on the rural component of the earlier study. After one year, it followed the same methodology and targeted the exact same sample, i.e. 735 students of all ages in 10 rural schools in the Dwesa community. Adding a longitudinal dimension highlighted a correlation between mobile and computer use. The frequency and range of activities increased organically across both devices, refusing the idea that mobile access somehow cannibalises computer use or vice-versa. However, the arrival of computers in some of the schools did not translate in an immediate increase in mobile use. This is consistent with the idea of a Digital Participation Curve proposed by Goldstuck. The daily use of mobile phones increased from 59 to 71% and weekly use increased from 3 to 17%. The fact that 20% of the respondents got a new phone during the year under consideration may explain a surge of 20 – 25% in multimedia activities. The analysis of networked activities such as Internet browsing and email indicates a concern for the cost of data, as indicated by the use of instant messaging instead of SMS.

The second site under consideration is Keiskammahoek, a rural community in the Ciskei region of the Eastern Cape. Despite being relatively close to urban centres, it is comparable to Dwesa in terms of size (approximately 20 000 inhabitants distributed across several villages); type of terrain (a combination of flat and mountainous); and socio-economic status (endemic poverty and reliance of Government grants). This allows for meaningful critical comparison of the findings for the two sites.

Keiskammahoek is the site of the Makana Apps Factory, a project sponsored by the Ikamva National eSkills Institute through the Eastern Cape CoLab. The goal of the project is to develop software and train the local community to exploit the potential of mobile for socio-economic development.

A survey of media and mobile use (Dalvit & Strelitz, 2013) was conducted in the area. This study confirmed low household access to computers but noted a high (67%) access outside the home. A relatively high percentage reported being able to perform productivity activities such as typing and searching for information, which suggests access at school or work. Access to mobile phones is almost universal and 80% had a phone for more than two years. Approximately two-thirds of the respondents acquired their phone over the past two years. Cost was the main factor determining network choice, followed by quality of signal. Each household spent an average R 160 a month on airtime. Half the sample only used phones for communication. Multimedia activities were performed by approximately 50% and networked activities by 40%. Interestingly, an additional 20% lived in households where at least one member performed either type of activity. Thus, mobile phone sharing extended the reach of feature-rich phones. Younger people appeared to be twice as likely to perform multimedia activities and three times as likely to use Internet features. This broad scope exploratory study formed the basis for a more focused survey, aimed inter-alia at informing apps development and training. The results of this more recent study are reported and discussed in the Findings section below.

Methodology

The methodology used was a survey using established data collection tools such as questionnaires and interviews. The main study was preceded by a pilot in a township chosen for convenience and accessibility. The questionnaires were originally written in English and were translated into
isiXhosa after the pilot. Previous research in the Keiskammahoek area (Dalvit & Strelitz, 2013) highlighted the importance of language issues and informed the development of the research tools used in the present study. This earlier research is also referred to for the purpose of comparison and validation.

The fieldworkers administered 180 questionnaires in six villages in the Keiskammahoek area, between 20 June and 20 July 2014. All fieldworkers were members of the local community with a sound understanding of the local context. Questionnaires were not self-administered by the respondents, but were filled in by the fieldworkers. Previous experiences conducting research in rural areas suggest that low levels of literacy and little familiarity with questionnaires warrant administration by a fieldworker rather than self-administration.

Ten fieldworkers received training on how to administer the questionnaire, working in pairs and collecting feedback to inform the final version of the data collection tool. This introduced a second step in the piloting and refinement of the questions and ensured consistency among fieldworkers. Only 12 questionnaires were excluded from data analysis as they were incomplete or because responses were internally inconsistent. Based on our experience with the application of survey methods in similar context, this is an exceptionally low figure.

The detailed summary of responses is attached as Appendix A. The relatively poor socio-economic status of most respondents is clearly captured by the data. Only 4% of respondents work full-time, 7% part-time and 82% are unemployed. The majority are young people under the age of 30.

As shown in Figure 1, approximately 34% are in between the ages of 11 and 20, 30% between 21 and 25 and 12% between 26 and 30. Only 10% are between 30 and 60 while 14% were over the age of 60. This is consistent with the demographic composition of the area, where most young people of working age migrate to the cities looking for jobs. Female respondents accounted for 56%. Gender composition reflects that of the Eastern Cape Province as Statistics SA’s 2013 mid-year population estimates report that 52.9% of Eastern Cape residents are female (Stats SA, 2013).

Findings

As noted by Donner and Gitau (2009) the experience of most rural users in South Africa is mobile-first and mobile-centric. This is confirmed by our survey in Keiskammahoek. Only 35% of
respondents have access to the Internet via means other than mobile phone. 7% used a tablet to access the internet, 3% used their own and 5% used one owned by a friend or family's tablet. 14% used their own PC or laptop, 21% a friend or family member's, 1% used a PC or laptop at work, 5% at a school. (See Figure 2)

![Figure 2: Access to Internet other than by mobile phone](image)

Given the remoteness of the area, a relatively high 31% used an Internet café, 13% used a public facility such as a community centre, library, clinic or other government facility and 7% some other point of access. This is consistent with the relatively high percentage of those who claim to have access to a computer outside the home, noted by Dalvit and Strelitz (2013).

As noted by Dalvit and Strelitz (2013) people in Keiskammahoek in general are experienced users of mobile phones and have had a comparatively large number of devices. 38% of respondents have owned more than three mobile phones and 86% have owned a phone for more than three years. Only 13% use the first phone they own.

Previous research on mobile use in rural areas highlights the importance of considering different type of activities as well as their frequency. Communication activities were the most common in the hour before being interviewed. 68% had used a mobile phone to make a call and 59% had used free services such as checking their airtime balance, retrieving a voice mail or sending a “please call me”. Only 34% had sent an SMS. By contrast, 43% used a phone to listen to music (27% on radio), 19% to take a picture and 16% to watch a video. Interestingly, although only 8% created a video using their mobile phone in the hour before the survey, 63% claim to have done so at some point in time.

Networked activities were frequent, considering the proportion of mobile phones which supported them. 43% used a social network and 35% instant messaging in the last hour. Although less frequent, instant messaging use was slightly more common than social networking (73 as opposed to 69% of respondents). Email was used only by 25% and just 7% in the last hour. Other networked activities such as searching for information, downloading files or browsing the Web were practiced by between 10 and 15% in the last hour, and by between 50 and 60% overall. These data confirm the progression noted by Dalvit and Strelitz (2013) from communication to multimedia to networked activities in terms of number of users as well as frequency.

These authors note a fourth set of activities, i.e. money-related uses. As noted below, this is one of the most common uses of apps. 36% of the respondents indicate that they do something related
to banking on their phone (e.g. check balance, pay bills etc). Airtime transfer, which as noted by Cristoferi and Dalvit (2013) can be considered a money-related use of mobile phones, was performed by 67% of the respondents and by 15% in the last hour. 29% have used mobile apps in the last hour and 55% have done so at some stage. Besides the uses discussed above checking news (40%) and, to a lesser extent, using maps (15%) were common apps. Only 2% use an antivirus and an additional 7% do activities like gaming and using a flashlight.

Despite the extremely high level of unemployment, every respondent reported that their household has at least one phone. This finding is significant since mobile phones are frequently shared between members of the same household. Households have an average of 2.9 phones. As expected smaller households (fewer than 5 people) accounted for 37% of the sample and have an average of 2.2 phones, Households with 5 to 10 people had an average of 4.1 phones. (See Figure 3)

Although phone sharing is common, only 54% said they would let someone else use their phone. 23% let other people use their phone to make calls, 14% to send SMS, 10% to make airtime transfers, 12% to take pictures, 13% to listen to music or the radio, 7% to watch videos, 5% to use social networks or send instant messages, 3% to search or use the internet and 1% to send email.

Of the reasons people gave for using other people’s phones, 34% was because it had more airtime, 18% to make an airtime transfer, 13% because it has better features (camera, radio, music), 11% because it has apps such as Facebook. Only 1% said it was because they did not have their own phones.

![Figure 3: Phones per household](image)

The most popular network operator is MTN (72%). Cheaper call rates were indicated as the main reason for network choice (37%) followed by signal quality (31%). In a rural area where network coverage is often patchy and not all areas are covered by all operators, this suggests a strong sensitivity to cost among the respondents.

Most respondents (55%) spend between R20 and R50 a month on airtime. Only 22% spend more than R50 a month on airtime and 23% spend less than R 20. Sim-jockeying, i.e., the practice of using more than one Sim card to take advantage of promotion on different networks and avoid MTRs (Mobile Termination Rates), is considered a strategy employed by people from a low so-
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cio-economic background to save on communication costs. Approximately 42% of the respondents use more than one Sim card.

Messaging provides an indication of how data are used to save on costs. Only 37% use SMS as their main way of sending messages, while 25% use WhatsApp, 14% Mxit, 16% Facebook, 4% email (although 25% had used email on a phone in the previous month) and 1% Twitter. In this question, respondents were asked to identify only one main way of sending messages, so it is an important indicator of how many residents 63% use data-based messaging systems on smartphones or feature phones, both of which use data and are capable of accessing the Internet.

In a separate question 72% said they had used any form of instant messaging (as distinct from SMS). 35% of these had used instant messaging in the previous hour and a further 18% in the previous day, indicating that a majority of respondents use instant messaging. Commenting on a family member’s mobile use, only 69% of respondents reported that the family member had never used instant messaging.

**Internet Access**

Of course, instant messaging is the most basic voluntary use of data (as opposed to background data: used by smartphones) (Figure 4). Social networking is a more substantial indicator of data use and use of phones to access the Internet. Some kind of social networking had been used at least by 69% of respondents and 43% had done so in the hour before the interview. 60% had used a search engine on a mobile phone, 57% surfed the internet (10% had done so in the previous hour and a further 17% in the previous day. 52% had downloaded files.

![Figure 4: Use of mobile Internet](image)

**Conclusions**

In this paper we proposed an articulation of the digital divide - with a particular focus on the data divide - along several dimensions (mobiles/computers, individual/shared, physical/epistemological, urban/rural). We reviewed past research in two comparable rural areas of the Eastern Cape, highlighting the complementarity between phone and computer access, the near universality of the former, the progression from communication to multimedia and networked activities and the interesting phenomenon of technology sharing. We then presented the results of a survey in Keiskammahoek, confirming many of the previous findings. A longitudinal approach and a focus on data revealed that basic activities are not only more common, but also more frequent. However, networked activities are rapidly increasing. Respondents show sensitivity to
cost, but also an ability to use advanced features (e.g., instant messaging) to save on their expenses. In summary, our paper suggests a rapid uptake of networked activities in rural areas despite the relatively low socio-economic status of most respondents. Mobile applications which are data-efficient and contribute meaningfully to the life of users definitely have a future in this important section of the South African population.

References


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**Biographies**

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**Steve Kromberg** is a trainer, strategy consultant and project manager, specialising in online, social and mobile media.

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An Empirical Study on the Use of the Sakai Learning Management System (LMS): Case of NUST, Zimbabwe

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Abstract

There has been a major increase in the use of information Communication Technology (ICT), particularly Electronic Learning (e-learning) blended with face-to-face (f2f) in teaching to cater for increased student enrolments. E-learning is a technology based method with time and space independence and facilitated by Learning Management Systems (LMSs), computer programs used to create, manage, deliver and retrieve learning content such as Sakai. Much prior studies on LMSs have focused on their adoption and acceptance. This research thus sought to understand the reasons for some lecturers to be dissatisfied with the e-learning platform experience despite their benefits. A questionnaire based survey of 70 lecturers was conducted. The results showed that lack of awareness and the technical knowhow were among the critical factors that influenced the utilization of the Sakai LMS at NUST. This provides useful information to the university management on the need and importance of the LMS users training and refresher courses.

Keywords: Learning Management System, e-learning platforms, Higher Education Institutions, information Communication Technology, utilization, academics, Sakai LMS.

Introduction

There has been an increase of Information Technology (IT) usage for teaching and learning, such as the use of mobile devices for an active learning process (Saadé et al., 2012). Mobile devices like smart phones enhance learning due to their being ubiquitous, spontaneous, fun, mobile and low cost (Selim, 2007). The growth in student enrolments and the shortage of lecturers has given rise to the need for ICT based teaching and learning such as e-learning systems. An e-Learning system is a flexible and convenient teaching method based on the internet connectivity (Lee & Lee, 2008; Pituch & Lee, 2006; Selim, 2007) that can curb the problems associated with increased student enrolments, high staff turnover and shortages of teaching resources. The literature has many benefits of e-learning system usage like the provision of quality education, time and place independence, course material accessibility, flexibility and convenience (Liaw, 2008). The National University of Science and Tech-
Study on the use of the Sakai Learning Management System (LMS)
nology (NUST) realizing the benefits of e-learning systems has embraced this technological in-
novation by adopting Sakai LMS in 2012. Despite the perceived benefits of e-learning systems,
many academics still do not use them, an indication that something is not working properly in e-
learning platforms. By considering the responses of lecturers who participated in the survey it
was possible to better understand the reasons why some lecturers at NUST do not have the e-
learning platform experience. The following section discusses the current problem in relation to
NUST academics, use of Sakai LMS, objectives of this study, reviewed literature, methodology
used and the results of this research.

Problem Statement
NUST acquired a dedicated internet line, dedicated electricity power supply line as well as the
generator for power backup to ensure continued use of the Sakai LMS. An initial training work-
shop was also conducted for the academics on how to use the LMS tools in the teaching activities.
The academics have been provided with the relevant hardware and software with each having at
least a personal desktop computer, laptop or tablet PCs to facilitate the utilization of the Sakai
LMS. Despite this costly initiative, only 20% of the academics are currently integrating the LMS
tools in the f2f teaching method. A survey was conducted where seventy paper based question-
naires were administered to the available academics. The questionnaire was based on both closed
and open ended questions for a richer understanding of the current situation of the Sakai LMS
usage. The survey results revealed that an insignificant number of academics have or are actually
integrating Sakai LMS tools into their teaching practices. Based on the questionnaire responses
only 20.5% academics have or are still using the LMS, a project that has been running since 2012.
The 79.5% non users could be merely resistant to this technological change or are being influ-
enced by other factors not to integrate the Sakai LMS tools in teaching. The LMS tools are not
used at all or are underutilized, robbing the students of an enjoyable, flexible, convenient and in-
teresting learning atmosphere. Above all, the institution is deprived of realizing the anticipated
return on their technological investment. It is against this background that the study was conduct-
ed.

Objectives
This study aimed at understanding the factors influencing the use of the Sakai LMS by academics
at NUST. The objectives were to establish the reasons for using the e-learning platform by aca-
demics and to establish if LMS utilization is affected by the level of user training and demograph-
ic variables such as computer experience, gender, social background and age (Asiri et al., 2012).
Prior studies have confirmed attitude, self efficacy, technological relative advantage, compatibil-
ity and complexity as major factors influencing the adoption and usability of technology. A rich
understanding of LMS utilization is of paramount importance as it informs the LMS developers,
researchers, education practitioners and the learning institution management to correct what is
wrong in the current LMS use phenomenon.

Literature Review
There are many LMSs such as MOODLE, Sakai, Blackboard, WebCT, Claroline, etc, which are
either commercial or open source. MOODLE and Sakai are the most preferred open source LMSs
due to their flexibility, ease of use, popularity and compatibility (Caminero et al., 2013;
Cigdemoglu et al., 2011). Although, of the two systems, Sakai better handles a large number of
users (Caminero et al., 2013) with about three hundred adoptions worldwide. These open source
LMS systems, overcome most of the drawbacks of commercial LMS systems where bugs are
quickly found and fixed and security patches are released more quickly (Albarrak et al., 2010).
LMSs are computer programs that facilitate e-learning through the creation of course content
(Lonn & Teasley, 2009; Martin-blas & Serrano-fernández, 2009). They have tools for assessment,
communication, uploading of content, return of students’ work, administration of student groups, questionnaires, tracking tools, wikis, blogs, chats, forums, etc over the internet.

LMSs are widely used in higher education for the creation, distribution, management, and retrieval of course materials, support interaction, enable institutional innovations in teaching and learning, provide tools for active online engagement such as discussion, summative assessment, chat rooms, wikis, and blogs (Cigdemoglu et al., 2011; Lonn & Teasley, 2009). LMSs are also beneficial for developing reciprocity and cooperation among learners, using active learning techniques, giving prompt feedback, emphasizing time on task, communicating high expectations, and respecting diverse talents and ways of learning (Wang et al., 2013). Other benefits of LMSs are increased degree of student-led learning, improved student morale, enhanced information skills acquisition and student achievement and may even reduce student withdrawals and absenteeism (Woods et al., 2004). In addition, some LMSs can automate notifications of due dates on a readily visible calendar, and some can automate direct email communication if students are not participating as required (Rubin et al., 2010). Much of the prior research describes LMS implementations, comparison with f2f, the adoption and continuance of use by learners where perceived usefulness, system characteristics, clarity of design, interaction with instructors, and active discussion significantly influenced their perceptions and had major influences on their use (Mcgill & Klobas, 2009). Despite the many advantages of LMSs, the major challenge of using LMS is their lack of capability to achieve pedagogical practices.

LMSs are currently not implemented and configured to help faculty engage in the seven principles of effective teaching, which are useful for enhancing learners’ satisfaction, improved teaching quality, productivity, and a high level of learning. Another disadvantage of LMSs is the lack of learners’ contact (Woods et al., 2004) making it difficult to monitor and evaluate individual learner progress. Some LMSs require manual and time-consuming processes to track participation and notify learners (Rubin et al., 2010) of expectations and also lack the tools for formative assessment. The LMSs research Sakai included is characterized by a diversity of studies conducted in a wide range of contexts aimed at various outcome variables based on different explanatory variables and models. This makes it difficult to generalize when trying to understand its utilization in the context of lecturers; an understudied group, hence this research.

Research Methodology

This research was based on a case study method an empirical inquiry that investigates a contemporary phenomenon within its real-life context and has the capability to utilize both qualitative and quantitative data collection and analysis. The quantitative technique is a quick data collection method used to identify and profile e-learning system users. The population of the study consisted of seventy lecturers who were administered with standard questionnaires in the six faculties of the NUST institution. The questionnaires provided quick responses on the factors influencing the use of the Sakai LMS. The questionnaires were not difficult to answer as they were structured in such a way that the respondents could choose the answers from a list. Questionnaires are convenient methods of data collection as their anonymity nature made the respondents provide valid information freely. They also could be completed at the respondent’s convenient spare time dedicated to the questionnaire. It was also easy to administer and collect them since they were administered and collected via the departmental secretaries to maintain the privacy and anonymity of the respondents.

The data were analyzed using the statistical package for social sciences (SPSS) version 20, a computer program for statistical analysis. Its advantages being that it enabled the scoring and analysis of quantitative data very quickly and in many different ways such as frequencies, affording the ability to derive answers quickly and with little effort as well as its ease of use in analyzing numerical data (Bryman & Cramer, 1999). A qualitative technique was used as a follow up to
elaborate more on the challenges to using the Sakai e-learning platform. The method collected qualitative data appropriate for this research because in (Miles, 1979) they are rich, full, earthy, holistic, real; valid; they preserve chronological flow, minimal distortion collection requires minimal front-end instrumentation and undeniable quality results. This method facilitated the collection of data in naturalistic settings based on the participants’ own categories of meaning, providing an understanding and description of the users’ personal experiences with e-learning platforms. The qualitative method also offered a rich understanding of how the e-learning platform tools were currently used as well as the motives of using the e-learning strategy. Collected individual case information resulted in a detailed research explaining factors influencing the pedagogical use of e-learning systems.

**Results**

The results from this research revealed that academics do not use the LMS for teaching mainly due to lack of knowhow of the system, thus confirming (Smet, et al., 2012, p. 690)’s assertion that “users need to acquire a basic factual knowledge level about technology before they are able to move on”. Only 65.9% respondents lacked technical knowhow of the Sakai LMS as they did not attend the once off training, which was never communicated to them. Lack of awareness about the system was another critical factor that influenced the use of the system since only 50% of respondents indicated awareness of Sakai LMS’s existence as indicated in Table 1.

<table>
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<th>CUMULATIVE PERCENT</th>
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<tr>
<td>Total</td>
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<td>100.0</td>
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More regular training on how to use the Sakai system is required as indicated in Figure 1. where 77.3% of respondents indicated a need for training on the Sakai LMS. This is an indication that with adequate and appropriate training there is a high potential of utilization of the system. The training will also benefit the 9.1% of academics who joined the institution after the implementation and the initial training on how to use the Sakai system. Of the 20.5% academics using the Sakai LMS, the results indicate that they primarily use it as a course information transmission tool. This is an underutilization of the system as it converts learners into passive consumers of the transmitted information rather than active participants in the learning process. Thus proving true (Woods et al. (2004)’s sentiments that few academics use an LMS for instructional purposes, and even fewer utilize it to foster a more positive sense of community within their face-to-face classes. In addition some of the Sakai users indicated challenges with the system such as its failure to integrate audio and video conferencing features for real time interactions, the constant power cuts, poor internet connectivity and lack of fully equipped computer laboratories for use by students.
Inspired by the discussed challenges, the study established that the Sakai LMS is an essential learning platform due to its availability, access to technical support, facilitation of communication and interaction between the lecturer and students, enabling of quick assessment and immediate feedback. Therefore it is a wise move to integrate it into the teaching and learning environment.

The study found that demographic issues such as gender, income and age had no influence on the use of the LMS. Also technophobia was not a factor since 88.6% had a working computer that they used for developing either presentation slides and lecture notes hand outs. An in-house developed LMS is currently being used in the departments of Applied Mathematics and Statistics and Operations Research an indication that e-learning systems are a valuable educational strategy not only at NUST but in higher education institutions.

**Conclusion**

The purpose of this paper was to develop a better understanding of lecturers’ acceptance of the Sakai LMS and establishing if they actually use it in their teaching. Though the results, discussed above have clearly helped to attain the research goals, a number of limitations are to be considered such as the learners’ experience with the system and the use of log files rather than questionnaires to get more accurate LMS related data. The study was limited by the unavailability of lecturers who were on leave since it was conducted during the long vacation. Nevertheless the study informed the education practitioners on the importance of training and the need for refresher training workshops for value-added use of LMSs. There is a positive correlation between technology use and user training for realization of return on the technological investment, a thought to be considered by higher learning institutions management.
References


Biographies

Sibusisiwe Dube is a PhD in Information Systems student at the University of Cape Town, South Africa. She has worked as a Lecturer at the National University of Science and Technology in Zimbabwe since 2008. She also worked as a Teaching Assistant at the Midlands State University in Zimbabwe from 2004 to 2008. She also worked as a secondary school Teacher for six years from 1994 to 2000. She holds a Master of Science degree in Computer Science, a Bachelor of Science Honors degree in Information Systems, a Post Graduate Diploma in Higher Education and a Diploma in Education. She has attended a number of conferences such as ICT4Africa and SACLA. She has also written conference papers appearing in the ICAT 2012, IST Africa 2013 and SACLA 2007 proceedings.

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The Adoption of Tablet Based e-Textbooks in a South African Private School

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Abstract

The research reported in this paper aims to obtain a better understanding of the factors influencing the adoption of tablet-based e-textbooks by focusing on a pilot project in which e-textbooks loaded onto tablets was used to supplement formal classroom learning in a South African private school.

The research adopts Cultural Historical Activity Theory (CHAT) as the theoretical framework of analysis and interpretative case study research as a research method. Several factors were identified that may have influenced the adoption of e-textbooks in the aforementioned environment (activity system) including tablet robustness, infrastructure, features afforded by the tablets and the e-books, user age, training and knowledge sharing, and expectation management.

Factors that may have to be considered for tablet-based e-textbooks to be implemented at a disadvantaged school in South Africa are discussed – the availability of electricity, security and student safety, infrastructure, and teacher skills. It is recognised that e-textbook technology might contribute towards addressing the skills shortage in the South African educational environment.

Keywords: Mobile Learning, Tablets, e-Textbooks, Technology Adoption, Developing Countries, Activity Theory

Introduction

As mobile devices become more readily available, new opportunities are being created for learning through these devices – also in South Africa. One such an opportunity is the provision of e-textbooks on tablets. E-textbooks are mostly less costly than their printed counterparts, one does not need as much storage space for e-textbooks as for printed textbooks and it can be revised/updated and distributed quicker than printed textbooks (Doering et al., 2012). On the downside the acceptance of e-textbooks is curbed by cultural resistance (Nelson, 2008), students might get distracted because of the possibility to connect to the Internet, printing is restricted or not possible and restricted portability might complicate the implementation (Doering et al, 2012).

Scholars agree that more research is needed to understand the result of implementing e-textbooks on teaching and learning practices (Daniel & Woody, 2013; Larson, 2010) to aid educators and administrators in their decisions to integrate e-textbooks into the curriculum.

Studies pertaining to the use and adoption of e-books and e-textbooks (via dif-
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Different mobile devices – PCs, laptops, tablets, netbooks, e-book readers, smart phones, etc.) in an educational setting are limited mostly to studies conducted in a tertiary education setting in developed countries – college and university students in the United States of America (Bryant & Mims, 2012; Diaz et al., 2010; Doering et al., 2012; Foasberg, 2011; Shrimplin et al., 2011), university students in Taiwan (Lai & Ulhas, 2012), university students in Hong Kong (Lam et al., 2009), and university students in Australia (Brand et al., 2011). Few studies focused on pre-tertiary education in developing countries – primary school teachers in South Africa (Power & Sankale, 2007), secondary school students in South Africa (Liebenberg, 2012), and primary, junior high school and senior high school students Ghana (Worldreader, 2012).

The lack of research on the implementation and adoption of e-textbooks in schools has been pointed out in the above discussion. This paper addresses this shortcoming by investigating factors that influence the adoption of tablet based e-textbooks during a pilot project (discussed in the next paragraph) in a secondary private school in South Africa. Moving away from quantitative adoption studies, this study attempts to reach a holistic understanding of contextual factors playing a role in the implementation of the e-textbook solution.

Background

In 2012 IT School Innovation (ITSI) - a South African ICT (Information and Communication Technology) education company – launched a pilot tablet-based mobile learning project (MobiliLearn) at a private high (secondary) school in South Africa that incorporates e-textbooks from Via Afrika. Via Afrika is a Media 24 company that created e-textbooks based on their traditional, CAPS-based textbooks. CAPS is the acronym for Curriculum Assessment Policy Statements – a single, comprehensive, and concise policy document, which will replace the current Subject and Learning Area Statements, Learning Programme Guidelines and Subject Assessment Guidelines for all the subjects listed in the National Curriculum Statement Grades R – 12 (Department of Education, 2013) in South Africa.

At the private high school, the entire grade ten group (about 40 students) was provided with Android-based tablets from ARCHOS (a consumer electronics) containing all of their required textbooks in electronic format (ePub). The students were provided with Internet access although the e-textbooks can be used without an Internet connection. Hotspots or additional content like videos, interactive illustrations, etc. are embedded in the e-textbooks.

The e-textbooks that were loaded onto the tablets can be paged like a normal textbook. Users can also underline and make notes in the e-textbook. Students were encouraged to interact with the content by means of hotspots included in the e-textbooks. Students also took these tablets home to do homework on them.

Teachers were also provided with extra educational resources via ITSI’s Virtual Learning Environment (VLE), which allows them to push content directly to the textbooks (e.g. pdf files, audio and video files). When students open the e-textbook, these files were immediately available at the appropriate place in the textbook. In addition, an open source school management system called Moodle was used. Moodle, a typical Learning Management System, was used to track marks, publish content (for example additional notes and quizzes) to students as well as receive items from them (for example assignments, etc.). A Wi-Fi network was used to link all of the tablets to the virtual learning environment. When it became apparent that the Internet was sometimes too slow to work with, students were provided with 3G cards to access the Internet.

Should a tablet break, students were issued with a loan tablet until the broken tablet could be fixed. Tablets were also insured against breakages. Because students’ tablet content was backed up on a server, the content of a lost, stolen, or broken tablet could be restored on a new tablet.
Important to note is that the aim of this project was not to replace traditional education, but to create a blended learning environment in which traditional face-to-face teaching and learning is enhanced with technology.

**Research Objective and Approach**

The objective of this study was to obtain a holistic understanding of factors influencing the adoption of e-textbooks by students and teachers in a secondary school. It therefore used a qualitative, interpretative research approach to accommodate the socially constructed nature of the case in point. To complement the interpretive research approach CHAT (Engeström, 2001) was used to analyse and understand how tablet-based e-textbooks are adopted in a blended learning environment. CHAT “shows the interactions between tool-mediated activity and the cultural rules, community and division of labour” (Liaw et al., 2010, p. 447).

It was decided on a case study research method, since case studies examine specific cases within their real life environments (as is the case when studying the use of tablet-based e-textbooks by students and teachers in a classroom setting). This case study is a descriptive case study that allows “rich, detailed analysis of a particular phenomenon and its contexts” (Oates, 2006, p. 143).

At the time of this study, the school was among a few schools in South Africa using tablet-based e-textbooks. It was, however, the first school using the specific e-textbook learning system introduced by ITSI. To obtain the viewpoints of different parties involved in the project, interviews were used as the main method for generating data. Three groups of interviews were conducted – interviews with five grade ten students involved in the project, interviews with two grade ten teachers involved in the project, and an interview with a representative from the IT-education company (ITSI) that provided the tablets, platform for the e-textbooks, and architecture required to effectively utilize the tablet-based e-textbooks.

After conducting the interviews, interview recordings were transcribed. These transcripts were then used to analyse interview responses based on the concepts of CHAT. Different theories were considered and CHAT was chosen because it enables a rich description of the complex learning environment as a whole.

**Activity Theory**

Several theories have been used to study the adoption and acceptance of e-books and e-textbooks in an educational setting. In a preliminary study, Brown (201, p. 7) expressed his intention to make use of several concepts from TAM (Technology Acceptance Model), the Task Technology Fit (TTF) model, and the Theory of Planned Behaviour (TPB) – usability, likability, intent to continue to use, etc. – to study “college students’ acceptance of e-books and e-readers as a viable alternative to traditional paper textbooks” (Brown, 2011, p. 5).

Doering et al. (2012, pp. 1-2) made use of Innovation Diffusion Theory (IDT) and the Gartner Hype-Cycle to structure their findings on the use of e-textbooks by students of an America college. The Gartner Hype-Cycle is an adoption of IDT that graphically denotes the maturity of a technology and can be used to determine when to invest in a new technology. Doering et al. (2012, p.10) show how participants perceive e-textbooks according to this model. In this study, Doering et al. (2012, p.10) found that “young and progressing college students are moderately traditional in their own attitude towards technology and… that the e-textbook technology needs further improvements and behavioural changes on the user side to be fully accepted”. Behavioural changes may include getting colleges, universities and their staff to understand and promote the advantages for students when using e-textbooks (e.g. cost, convenience, enhanced learning, etc.). Doering et al. (2012, p. 11) note that students and teachers “may have to break with old habits”.

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This remark alludes to the potential disruptive nature of e-textbook technology. Therefore, in order to understand the adoption of e-textbooks in a traditional school environment, a theory is needed that not only describes a person or a group's goals and individual or collective experiences, but also provides a framework to place and discuss these aspects from a social, organisational and cultural perspective. Activity Theory enables this broader understanding as will be demonstrated in the next section.

Activity Theory developed through three generations of research. The first generation of Activity Theory was introduced by Russian psychologist Vygotsky (1978). The unit of analysis of the first generation of Activity Theory is the individual’s action and it has been formulated as a triangular unity consisting of subject, object and a mediating artifact. The object is the primary focus of the activity system (Jonassen et al., 1999, cited by Hardman, 2007a, p. 54) and the object is concerned with the motive of the activity – that which drives the activity. The properties of the object also affect the subject and, by internalisation, transform him/her too (Kuutti, 1996, cited by Uden, 2008, p. 5). An activity system can only be understood by considering its history, which includes the local history of the activity and its objects, and the history of the tools shaping the activity (Engeström, 2001).

![Figure 1: The Structure of a Human Activity System](Engeström, 1987, p 78)

Within the CHAT school of research (third generation), the triangle subject-mediation-object was extended by Engeström (1987, p. 78). The division of labour is included which mediates the relationship between the object and the community (the individuals that share an object) (Figure 1). The division of labour describes how the activity (work) is distributed amongst the members of the community – what the role of each individual in the community is with regards to the activity; the power that each individual can exercise; and the tasks that he/she is responsible for. When the work is divided amongst members of the community, rules are required to control and allow exchange and interaction among the members (Engeström, 2009, p. 23). In effect, rules mediate the relationship between a subject and its community. Rules can be implicit and explicit. Examples of explicit rules include clear standards, policies, laws, etc. Implicit rules can include, amongst others, unclear social norms and relationships between individuals within the community.

Activity systems are constantly changing. These changes are being driven by contradictions (Engeström, 1987, cited by Hardman, 2007b, p. 112). Contradictions are “historically accumulating structural tensions within and between activity systems” (Engeström, 2000, p. 137), which can become apparent through problems, conflicts, ruptures, failures, etc. It is possible for an activity system to undergo expansive transformation. Expansive transformation occurs when "the object
and motive of the activity are reconceptualised to embrace a radically wider horizon of possibilities than in the previous mode of the activity” (Engeström, 2001, p. 137).

Findings

From the analysis of the interviews using the concepts and principles of CHAT, a rich picture emerged describing two interacting activity systems – that of the students and that of the teachers. These activity systems and the resulting outcome of it are described below. The differences between the two identified activity systems are very slight and consequently their components will be discussed jointly in the sections that follow. The two activity systems are summarised in Figure 2. In the analysis, difficulties, conflicts and frustrations are highlighted, since these are seen as contradictions that when addressed, might lead to expansive transformation of the activity system.

Subject

Two sets of subjects (or subject groups) have been identified – the grade ten students and the grade ten teachers.

The grade ten students were very excited to be involved in the tablet-based e-textbook project, making them willing to be involved in the activity and to use the new tools. Only some of students have had previous exposure to tablets. Although most students were very comfortable with the activity (especially using tablets and e-textbooks in the activity), it took some students a while longer to become comfortable with the new tools being used. A clear change in their attitudes towards the new tools could be observed (by their teachers) as they became more comfortable with the tools.

A teacher noted that many students also felt more empowered by making use of tablet-based e-textbooks, as it is a technology that they feel comfortable with and often have mastered more than their teachers have. Students have also shown more initiative – “[they] go home and find apps that would help in class”, a teacher explained.

Some of the teachers involved in the project did have prior experience with tablets. The younger teachers seemed a lot more comfortable with the use of tablets and e-textbooks than the older teachers were.

Object

For students the object of the activity (Object₁) was to use the new technologies provided to them to improve their learning and to obtain better results (marks). A teacher noted: “It’s been in my class a lot more engaging with boys who didn’t care [before], because they are now interested”. This shows how the subjects were also transformed by the properties of the object.

Figure 2 depicts how the initial, objects (Object₁) of two interdependent activity systems are reconstructed by the activity system to become collectively meaningful objects (Object₂). In such a connection of activity systems the objects can also evolve to become a “shared or jointly constructed object” (Object₃) (Engeström, 2001, p. 136).

For the teachers, the object of the activity (Object₁) was thus to effectively make use of the new technologies in their teachings to better facilitate learning. A combined object of the two activity systems (Object₃) can be described as using new technologies to successfully bring about an effective blended learning environment in which all subjects (teachers as well as students) can obtain better results, without more effort.
A third object (Object3) or eventual outcome (transformed object) emerged from the interaction between the students’ and the teachers’ activity systems. From the interviews, it emerged that students as well as teachers were working toward a different way of learning – actually, a different way of thinking. A student noted that since the inception of the project, he had learned “not always to study out of [traditional] textbooks, [but] to find other resources”. For the same student, the advantage that being involved in the project (and with new technologies at an early stage) held for him when he goes to university was important. A teacher also mentioned that she aspired towards getting her students to “think out of the box, not to see the textbook as the only source of information, but to be able to combine different sources of information” and so, to prepare them (the students) for university. A student later, in a separate interview, explained how she has been taught to “think outside of the box”. External activities mediated by the e-textbooks therefore re-
sulted in the shaping of internal activities – one of the basic principles of Activity Theory (Engeström, 2001).

**Tools**

From the interviews, numerous mediating artefacts (or tools) have been identified that the subjects use to achieve their objective (object) – the main of which were tablets and the e-textbooks that have been loaded onto these tablets.

Students and teachers highlighted several features of e-textbooks and the tablets that it was loaded on that they (the students) found advantageous and assisted in reaching their object:

- The tablets and e-textbooks made use of a very intuitive interface – for some students easier to use than their traditional textbooks.
- All textbooks were in one place (on one device), making it less likely for students to forget an e-textbook at home. (Figure 3)
- Students’ book bags were considerably lighter.
- E-textbooks could not get damaged (like pages tearing, getting lost, etc.).
- Students could make additional notes and drawings in an e-textbook that could later be referred back to again when they study.
- Content embedded in e-textbooks (like hotspots, videos, simulations, interactive illustrations, recordings, etc.) helped to further explain difficult topics.
- The ability to search for keywords in an e-textbook made finding content in the e-textbooks a lot easier than when using traditional textbooks. One student noted that he liked how “you always [have] all or most of the information right in front of you – you don’t have to run through the pages, you can just quickly go onto the index and click and it throws you into the pages that you want”.
- E-textbooks, with its different types of content (videos, recording, songs, simulations, etc.), made it easier for different types of students to be kept focused and to understand topics. One student noted that he is a visual and kinaesthetic student and that learning and understanding had become easier for him as the e-textbooks allowed him to move around (for example in interactive illustrations and simulations) and also provided many
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visual aids (like videos) that would not have been available to him in a traditional textbook. Another student explained that for auditory students there were some cases where songs were linked to specific subject matter.

- A teacher explained that additional notes and information could be added to an existing e-textbook, eliminating the need for them (the teachers) to photocopy notes for students.

On the other hand, students and teachers (subjects) experienced several problems with the e-textbooks and the tablets (tools) which caused frustration:

- Switching/flipping between pages of the same e-textbook was found to be difficult and often time consuming for some students.
- Very structured students and teachers became frustrated with how they could not order all their learning/teaching content the way they liked it. For example, some of their work was on the tablet, other in written books and different applications – not all in one file or structured according to their liking.
- Students and teachers experienced problems with tablet chargers and USB ports (where flash drives would break off inside the tablets’ USB ports). The USB problem was a factory fault with the specific batch of tablets and has since been rectified.
- Subjects had trouble getting used to using documents in the ePub format, as these documents do not have page numbers. Subsequently, many subjects used documents in PDF format instead. However, documents in PDF format do not wrap making them more difficult to read, as one has to scroll sideways.
- Some students also found it difficult to read from the tablet screens. In such cases, students would print their notes out and rather read from the paper copies.
- During the project, the school had a problem with slow Internet – To counter this, students (and teachers) were given an additional tool – a 3G card to allow them to access the Internet via a 3G connection instead. In this case, the activity was changed (or) developed by adding an additional tool.

In some classes exercises that had been printed out are still used in homework assignments and especially in language classes students were still expected to write in traditional workbooks. As a teacher noted: “I don’t believe I should be stuck using only the tablet.”

Introductory training courses were offered to assist in familiarising teachers and students with the use of tablets, e-textbooks, and the Virtual Learning Environment (VLE), and to advise them on what to do when certain problems are encountered. It took the students approximately two weeks to get comfortable with using the tablets and the e-textbooks. She explained that “[E]veryone caught on really fast”, but emphasised that “the two weeks of training really helped [them] – without that it wouldn’t have been that fast”. This sentiment was echoed by a teacher: “We had a girl who was terrified of tablets, but by the end [of the training course], she was comfortable [with using a tablet and e-textbooks].”

The teachers also explained that they regularly attended a knowledge cafe where teachers got together to discuss how the e-textbooks and tablets were being used in their classrooms. Teachers that were already involved in the project as well as those who were not yet making use of tablet-based textbooks in their teachings attended these sessions. The latter were also involved in these knowledge transfer session, so that when they do have to make use of tablets and e-textbooks, it won’t be a foreign concept to them and so that they had an idea of what to expect. However, despite receiving their tablets well before the students did, there were still some of the older teachers that showed signs of resistance towards the tablets and e-textbooks. One of the students inter-
viewed noted that the younger teachers were “more experienced with the technology and playing around with it.” Another student was of the opinion that assigning younger teachers to the grade ten group “helped the situation a little”.

Older teachers wanted to block access to the Internet completely. Younger teachers did not want to block Internet access, as they felt it was more important to teach students responsibility (to not use the Internet when they aren’t allowed to) instead. Finally, only soft-blocks were put in place, blocking access to certain sites (like social networking sites). Here a teacher noted that the students were a lot better behaved than was expected – “they acted a lot more responsibly [than was anticipated].”

The slow Internet also caused conflict between the teaching methods teachers used. Because of the slow Internet, not all students could make use of the Internet at the same time. Some teachers then changed their teaching method to include the use of smaller breakaway groups, with each group discussing a different topic or having a different task, so that not all groups would have to make use of the Internet at the same time.

Lesson structures (which can be seen as being part of a teaching method and a teaching tool) also had to be adapted in some cases, to allow the incorporation of tablets and e-textbooks. Typically a teacher would start with an appropriate introduction during which students would realise that they had to switch their tablets on or students had to be given specific instruction to switch their tablets on, after which the teacher would do an introduction (without the use of tablets) whilst waiting for the tablets to switch on. As a teacher explains: “I can’t just say ‘take out your books and write the date and start’ – there is a little bit of a delay”.

**Community and Division of Labour**

Several participants of the activities that share the same object were identified. Most of the participants were involved in both the activity from the grade ten students’ viewpoint as well as the activity from the grade ten teachers’ viewpoint (see Figure 2).

The following stakeholders and roles have been identified:

- The school governing body made the decision – with the parents and teachers – to get involved in the project.
- ITSI and the school’s own IT support team: ITSI sourced the Android tablets and provided the platform for the e-textbooks as well as the architecture required to effectively utilize the tablet-based e-textbooks. The school’s IT support team was involved in the first line support of the infrastructure and the tablets.
- Via Afrika was responsible for providing the CAPS-approved e-textbooks.
- ARCHOS provided the tablets at a special rate for schools.
- The parents of the grade ten students were responsible for buying the tablets that their children were using in class. The teachers remarked that some parent’s initial excitement turned to frustration and anger when any tablets, SD cards, etc. broke. These unhappy parents would then negatively influence the opinions of other parents. Another teacher noted that the parents expected immediate results and did not take into consideration that the project (the use of tablet-based e-textbooks) would take some time to settle and that there would initially be some take-on problems.

Grade ten students were expected to be positive about using tablet-based e-textbooks in a blended learning environment. They were also responsible for learning how to use the tools provided to
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them (mainly tablet-based e-textbooks) within the boundaries set by the usage policy, to study and to learn with.

The role of grade ten teachers within the activity, was to learn a new technology (the tablets and tablet-based e-textbooks), to make it their own and to use it in their teachings to convey learning material to the students so that learning can take place. Although the use of new tools (tablets and e-textbooks) was by no means an attempt to replace teachers, a teacher did note that her role as teacher had moved more towards being a facilitator. This indicates a slight shift in teachers’ roles. From the students’ viewpoint, they also did not see the tablets and e-textbooks as a means of replacing their teachers, but instead as something that would bring about a change in the way they learn. One of the students noted that even though he now had the means to further investigate or revisit a topic of study that was unclear to him by viewing additional videos and illustrations embedded in the e-textbooks, he sometimes still required a teacher to explain the topic to him - “[s]ometimes a teacher knows how to explain a topic better.” Another student noted that sometimes a face to face explanation is still required for better understanding.

Friends from other schools (in the grade ten students’ activity system) wanted to join their friends, because they also wanted to use tablet-based e-textbooks instead of traditional textbooks. As a teacher noted: “Every time there has been a newspaper article (e.g., Ellis, 2012; Tech Smart, 2012), then there are more groups of people that want to come around and see what’s going on.”

Other students from the same school that were not involved in the tablet-based e-textbook project (in the grade ten students’ activity system): For roughly the first month that the grade ten group was using tablet-based e-textbooks, other students in the school that were not involved in the project were very jealous of them. However, according to one of the teachers interviewed, these students’ jealousy eventually subsided, especially when they realized that the pilot project would in the end also help them to make use of tablet-based e-textbooks.

Fellow teachers (in the grade ten teachers’ activity system) that were not involved in the grade ten tablet-base project) were included in knowledge transfer sessions (Knowledge Café), so that when they had to make use of tablet-base e-textbooks in future, it wouldn’t be a foreign concept to them and so that they would know what to expect.

The school’s project coordinator’s (in the grade ten teachers’ activity system) role at the school was to coordinate the use of tablet-based e-textbooks at a high-level, and in essence to be the project champion. This included heading the Knowledge Café sessions, ensuring that teachers and students receive adequate training, managing teacher, student and parent expectations of and attitudes toward the project, assisting students and teachers with problems encountered with the new tools, and escalating these problems to the relevant parties (like the school’s IT support team, ITSI, etc.) when required. A teacher noted that she found the project coordinator to be of much help – “If you don’t know something, you go to her and she does as much as she can [to help you].”

Rules

One of the first rules that had an effect on the activity was budget constraints. As mentioned in the interviews, budget constraints affected how the project was executed in terms of the tools being used. Because of budget constraints, a sufficient Wi-Fi could not be installed when the project started.

A formal policy was put in place that stipulated what students were and weren’t allowed to do with the tablets (for example, students were not allowed to visit certain websites, play games on the tablets during class time, or make use of social communication services and networks (like GTalk and Facebook)). Students as well as their parents had to undersign this policy. To help
enforce these rules, soft-blocks were put in place to prohibit access to certain websites. Should a student not adhere to the usage policy, their tablets were white-listed or taken away in severe cases. Software was used to manage the white-listing of tablets and black-listing of applications.

Copyright also now had to be considered. Via Afrika encrypted their e-textbooks to avoid it being illegally distributed. Teachers also had to ensure that the additional content that they included in their textbooks and e-textbooks did not infringe any copyright laws.

Because it was now easier for students to copy answers straight from their tablets (from e-textbooks or web content) into their assignments and workbooks, students had to be made specifically aware of rules pertaining to plagiarism.

Normal school rules still applied in the activity system (rules such as students being respectful towards teachers, keeping quiet when a teacher is speaking, no cellphones allowed in class, etc.). However, when there was a problem with a tablet (e.g. it was broken or its battery was flat) a teacher had allowed students to use their cellphones to complete the task, as she felt that “it [a cellphone] is the same kind of technology [as a tablet] – it’s also got Internet… [and] all the same things [functionality].”

**Outcome**

The object of the activity is shaped and transformed into an outcome. In this case the blended learning environment that is created (and with it the exposure to new technologies), eventually translates into students learning to think for themselves and not to be restricted by conventional ways of information acquisition and thinking. In doing so, students become more ready for tertiary education – not just by having learned a different way of thinking, but also by having a technological advantage that exposure to new technologies provided them with. As one of the students interviewed explained: “In university most of their stuff [study material] is already electronically [available]”. He also believes that exposure to tools such as tablet-based e-textbooks will help them (the students) keep up to date with technology so that they don’t have “to all of a sudden, immediately adapt [to] it later after school.”

In essence the outcome of the activity can also be seen as a new, better way of learning – learning that is more integrated and more accessible to students and that teaches them to think for themselves. The ITSI representative sees it as a stepping stone “to eventually get to a flip classroom where the kids go away and then they come to the teacher and ask the teacher [questions], because that is a way of learning – that is teaching thinking, not just parroting”.

At the time of the study, this activity had only been ‘taking place’ for approximately nine months. Because of this limited timeframe, it was difficult to establish whether this outcome had indeed been reached. However, students interviewed did feel that involvement in the activity (or in the project) had already taught them to think differently.

**e-Textbooks in a Developing Context**

The private school in this case study is situated in a developing country but enjoys the privileges of the developed world. These students were asked if they thought that a similar project would be successful in a disadvantaged school. At first the interviewees believed it not to be feasible. One student noted that if the disadvantaged schools are in rural areas electricity would be an issue, as the tablets would need to charge. A second student said that solar panels could be used to provide electricity for charging tablets in areas with no electricity.

High crime rates were also a concern. They thought that providing a child with a tablet would make him/her a target for crime. One of the students suggested that perhaps the students in these
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schools should only use the tablet-based e-textbook in the classroom and then have printouts to take home for homework, or write down their homework assignments.

The teachers interviewed thought that a similar project could be successful in a disadvantaged school, but also stressed that a number of factors would have to be considered. One teacher explained that a sufficient number of competent persons would be required to drive such a project in a disadvantaged school. Another noted that proper training (for students and teachers) would be crucial to the success of such a project (a sentiment shared by the ITSI representative interviewed). She also believed that issues may take longer to resolve in such school, but that it (the tablet-based e-textbooks) would give them better access to educational resources.

An ITSI representative noted that ITSI has been involved in mobile learning projects at disadvantaged schools and believes that a similar tablet-based e-textbook project would be successful in such schools, “but [that] those teachers would need a lot more training and a lot more upskilling”. In these mobile learning projects students did not take tablets home. Instead tablets were slotted into a special trolley and left at school to charge (Voigt and Matthee, 2012). She also believed that it would be successful in terms of student adoption, because children have cellphones, and because from a cellphone to a smartphone to a tablet is very intuitive. In these projects two students shared a tablet. In one case some of the teachers used the content on the tablets to prepare for their lessons, “because they forgot that [mathematics concepts] or didn’t quite understand it”.

According to the ITSI representative, the ability to embed content into textbooks can also be very advantageous in disadvantaged schools – especially where there is a shortage in teachers. In such cases teachers from a different school can record himself/herself during a lesson, embed the recording into the e-textbook and send it to the school that does not have a teacher.

The ITSI representative also believes that it could be more cost effective to make use of e-textbooks instead of traditional textbooks. By ordering in bulk, tablets can be obtained at a discounted rate. The cost of an e-textbook is also considerably less than the cost of a traditional textbook. As the servers required for such projects are not very large – standalone Pentium 4 computers are sufficient servers – the cost of a server is minimal. That being said, the initial expense would be somewhat higher because the tablets will have to be purchased, but as the ITSI representative noted: “in two years’ time it is going to pay itself”.

Discussion

It is clear that the e-textbooks were more than mere replacements of printed textbooks. Apart from text it provided a platform where students can take notes, make highlights and summaries and teachers can push content to. The interviews show that the new technology as mediator provided several advantages but also caused new obstacles towards carrying out the task of teaching and learning. Most of the obstacles can be ascribed to the difference in history and affordances between the old (textbook) and new (e-textbook) technology.

The first factor that seemed to affect teachers’ and students’ adoption of the e-textbook is concerned with the robustness of the tablet. Tablets that gave problems with chargers and USB ports caused conflict and negatively affected adoption.

Second, problems with infrastructure (an initially inadequate Wi-Fi network and slow Internet access) also influence adoption of the new technologies negatively. However, the negative impact this had on adoption was minimized by the positive effect of expectation management (discussed later in this section).

The (new) features that the tablets and e-textbooks afforded, affected adoption both negatively and positively. The switching/flippering between pages proved troublesome to some students and teachers, making them less willing to adopt the new technology. On the other hand, features such
an intuitive interface, interactive simulations, videos, audio recordings, the ability to make notes, keyword searches, and so on encouraged teachers and students to adopt the new technology with less resistance.

A correlation between age and adoption was also found. Students and younger teachers were more open minded towards using and adopting the new technology, whilst older teachers adopted the new technology with much more resistance.

Two factors that affected adoption in a positive manner are expectation management coupled with training. Even though there were some parents that had unrealistic expectations of the project, these were mostly curbed. Issues that arose during the first couple of months of the project were not unexpected, because students’ and parents’ expectations were managed from well before the project was implemented. Training before the project launch as well as during the project seemed to have a significant impact on students’ as well as teachers’ acceptance of the new technology, as it allowed them to feel confident in and comfortable with the use of the tablets and the e-textbooks.

The regular knowledge sharing sessions and having an in-house project champion around to refer issues and queries to, also positively affected adoption from the teachers’ perspective. The knowledge the teachers gained in the knowledge sharing sessions made them feel more comfortable with using the new technologies. Having a project champion that is considered “one of their own” (from the teachers’ perspective) and that they can feel comfortable approaching (teachers may feel uncomfortable approaching an outside person, for fear of looking incompetent or being embarrassed) also makes teachers more likely to accept the new technology.

One teacher also noted that if you speak to the students everyone will always say that they would never want to revert back to traditional textbooks – even though they may have experienced some problems during the first few months of the project. Now, two years later, e-textbooks are an integral part of the school environment.

What are the implications of these findings for the rest of South Africa? Should one be able to get around all of the obstacles mentioned earlier, e-textbooks could be very beneficial to teachers as well as students in especially the deep rural areas. According to the ITSI representative, the ability to embed content into textbooks can be advantageous where there is a shortage in teachers or teacher skills. In such cases a teacher from a different school can record him-/herself during a lesson, embed the recording into the e-textbook and send it to the school that does not have a teacher. Just so, where there is a lack of teacher skills a teacher can up-skill him-/herself before a lesson by working through examples, videos, etc. that are part of the standard e-textbook or that have been included by a more skilled teacher. E-textbooks could potentially contribute toward the solution to the skills shortage in the South African educational environment.

**Conclusion**

The reported research in this paper aimed at getting a holistic understanding of factors influencing the adoption of e-textbooks in schools. In this way, the research contributes towards the limited research on the implementation of e-textbooks in schools. It is shown that the new technology asks for new infrastructure, new skills sets and new ways of being teacher and student in and out of the classroom. It leads to resistance but also expansive transformation (Engeström, 2001) when teachers and students need to adapt and find alternative (and often novel) ways to conduct a class or use a textbook. Despite the practical obstacles, this technology might offer several advantages to schools in a developing context by enabling students and teachers to access more resources and broadening the learning environment.
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This study was conducted in 2012 involving a limited number of students and teachers. The focus was not on the influence this adoption had on the academic performance of the learners but only on the obstacles to the adoption of the technology. Also, no follow-up study was done on the status quo at the school although a representative from the school described the e-textbooks to be an integral part of the learning environment currently. It might be very informative to determine the state of acceptance and usage of the e-textbook technology in the school as well as the effect it has on the results and learning experiences of the students.

References


### Biographies

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Competencies for the Successful Use of Online Social Simulation Games within Organisational Leadership Development

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Abstract

The humble Pong arcade game at the corner store ignited a fundamental culture shift in the 1970s and it is increasingly gaining momentum. A generation of gamers is already permeating organisations. The socio-cultural phenomenon of digital gaming has become pervasive. The intersection point of the three trends, Ubiquitous Computing, Ubiquitous Gaming and Social Networking is the focus point of this study. It is at this intersection point that both social online gaming and cutting-edge leadership competencies co-exist and have the potential to flourish when implemented with caution and circumspection.

Social Online Simulation Gaming (SOSG) as a learning design and learning technology can prove particularly valuable as a leadership and skills development tool within the “digimodern” world. Current literature, however, does not provide a clearly focused framework for the implementation of ICT supported game-based Leadership Development technologies within the information economy.

There is currently not a clear and specific framework for evaluating the Information and Communication Technology (ICT) competencies, knowledge, skills and attitudes required to successfully use Social Online Simulation Games software within the context of Organisational Leadership Development. This study aims to create and refine a framework for evaluating the ICT competencies required to successfully implement SOSG as Leadership Development tool.

The primary research question is formulated as follows: What ICT competencies (knowledge, attitudes and skills) are necessary to successfully utilise Social Online Simulation Games as Leadership Development technique and tool?

A Mixed Methods research approach was followed in which the current literature has been reviewed, using an interpretative methodology and the principles of hermeneutics, in order to derive a preliminary conceptual model for the ICT-related competencies (e-Competencies) needed for the successful implementation of SOSG in Organisational Leadership Development. Subsequently, this conceptual framework has been refined utilising the input of an international panel of experts (through a two-stage Delphi ex-
pert panel and further quantitative data analysis) in order to produce a framework for assessing the required competencies.

Significant differences between the agreement and consensus of Serious Games (SG) and Leadership Development (LD) groups of experts were observed. The differences indicate that the design and compilation of SOSG project implementation teams need to take cognisance of this reality and the aim to control it. It has significant implications on how the SOSG Utilisation Framework can be implemented in practice.

Our analysis suggests that the SOSG Utilisation Framework may potentially form a robust basis for further refinement of the competencies required to successfully utilise SOSG in Leadership Development applications within organisations.

**Keywords:** Social Online Simulation Games, e-Competencies, e-Competence Framework, e-Learning, Experiential Learning

**Introduction**

According to Bytheway (2003), it is relatively easy to formulate business strategy that aims to exploit the opportunities potentially offered by information technology. In the same vein, it is equally easy to spend money on perceived information technology opportunities. The real challenge lies in the space between these two factors. Ensuring that information technology adds value in terms of strategy realisation implies a myriad of challenges: *The problem lies in the space between these two, in the uncertain world of project management, systems implementation, business change management, benefits delivery, and performance management* (Bytheway, 2003).

For example, implementation of Social Online Simulation Games (SOSG) as Leadership Development tool within the developing world potentially faces the current challenge of varying levels of ICT competencies (knowledge, skills and attitudes), as identified in the European e-Competence Framework (e-CF) (CEN, 2010). This can hamper effective implementation of online simulation games to build leadership competencies in an organisation.

In the literature there is currently not a clear and specific framework for evaluating the competencies (knowledge, skills and attitudes) required to successfully use Social Online Simulation Games technology within the context of Organisational Leadership Development. Although various frameworks exist with the aim of explaining aspects such as computer mediated learning, e-Learning and technology acceptance, these models rarely focus on relevant underlying factors such as Flow Theory (Csikszentmihalyi, 1990) and Scopes’ Cybergogical Rationale (Scopes, 2009) which better explain learner engagement within game-based learning.

These factors are also typically lacking in current competency models often utilised by organisations such as the European e-Competence Framework and other similar frameworks, i.e. the Canadian Occupational Skills Framework (ICTC, 2012), the United Kingdom’s Skills Framework for the Information Age developed by the SFIA Foundation (2012), and the German Kompetenzzentrum IT-Bildungszentren, developed by Kibnet (2012).

Given the currently observed increases in utilisation of game-based technology by organisations, such a framework may assist both organisational executives and managers tasked with conceptualising and implementing such projects.

The primary research question has been formulated as follows: *What competencies (knowledge, attitudes and skills) are necessary for organisations to successfully utilise Social Online Simulation Games as Leadership Development tool?*

The following sub-questions have been investigated:
Do the current technology utilisation frameworks and/or models in literature provide an adequate typology of required competencies?

Are any additional competencies required for Social Online Simulation Games utilisation?

Can a rating and weighting of more critical competencies be suggested in the form of a framework?

What can such a framework potentially look like in practice?

**Literature Review**

As a result of the increasing ubiquity of advanced computing abilities and technology within the knowledge economy, development of leadership competencies is essential to organisational survival and success (Broos & Cronje, 2009; Ward & Prosser, 2011). Within a post-postmodernist epoch, the utilisation of ICT supported Leadership Development technology needs to take into account the changing in the nature of learning itself, as well as the expectations of learners (Harteis, Gruber, & Hertramph, 2010; Kirby, 2006).

It may also be beneficial to investigate leadership as process ontology, rather than a static concept. This means viewing leadership in terms of processes, interactions and practices “as socially constructed, emergent organising embedded in sociocultural contexts” (Crevani, Lindgren, & Packendorff, 2010). According to Allen (2006), Leadership Development has been on the minds and in the writings of major scholars over the centuries, from Confucius to Plato and from Machiavelli to Napoleon. In order to arrive at a definition of Leadership Development, Scott Allen (2006), in his insightful PhD thesis, proposes a synthesis of fifteen definitions in the literature into four broader themes.

Allen arrives at the following definition, which we will also utilise as our operational definition during this study: **Leadership development is a continuous, systemic process designed to expand the capacities and awareness of individuals, groups, and organisations in an effort to meet shared goals and objectives** (Allen, 2006).

When we analyse the major leadership schools of thought as metanarratives, it becomes evident that several of these approaches, such as the Trait and Style approach, as well as the Leader-Member Exchange Theory, can be viewed inherently as metatheories.

If a high-level longitudinal analysis is done of the major leadership theories, the following elements become apparent in modern leadership thought:

- A gradual recognition of the inherently networked nature of leadership (i.e., Yukl et al. as cited in Hogan, Curphy, & Hogan, 1994)
- An increasing awareness of the high levels of self-awareness and authenticity required to be able to exercise truly flexible situational leadership (i.e., Walumbwa et al., 2008)
- A gradual move away from the strictly dyadic relationship between leaders and followers (i.e., Sydänmaanlakka, 2003)
- An increased pessimism of the “Leader as Hero”- model (Walton, 2007)

Kriz (2003) argues strongly for the role that simulation games can play in creating learning environments that can successfully develop usable knowledge and competencies, while enabling user control and situational focus, in our opinion a critical requirement of modern learning and Leadership Development.
The development of the World Wide Web has extended the social reach and social power of computer games, starting with the earliest text based multiplayer dungeons games (MUDs) of the 1980s. Hundreds of thousands of players were suddenly starting to interact with and participate in shared rule-based communities in an online and increasingly mobile environment. The Korean game Lineage for example attracts millions of players and lasts over years. Everquest and World of Warcraft sustain hundreds of thousands of players. A common element of these worlds is the negotiation of social rules of behaviour, such as property rights and even ethically controversial issues such as player-against-player killing (Murray, 2006).

Further analysis of the prevalence of these types of Social Online Gaming and its growing presence as a factor in modern culture is required in order to contextualise and evaluate its potential utility in Leadership Development. Roger Caillois, a sociologist, describes in his classic work, Man, Play and Games, all forms of play as being positioned on an axis between two extremes: Paidia and Ludus (as cited in Caillois, 1961). He describes Padia as “a primary power of improvisation and joy”. The opposite pole, namely Ludus, is defined as “a taste for gratuitous difficulty”, typically introduced by the system of rule being applied.

One of the most important elements of games, and especially simulation games, is the manner in which productive failure and creative adaptability is encouraged: A lot of games give the illusion of freedom, but the formal structure of “how the game should be played” only allows freedom within these carefully constrained limits. True freedom in design gives the players the opportunity to wilfully fail at the task they have been given. By giving the player freedom to do this, they can generate their own goals that are not dependent on playing within the constraints of the “normal” way a game is played (Kirman, 2010).

Kirman (2010) also mentions the fact that a lot of games are designed “either purposefully or by accident, with low barriers to non-linear play”. Players are increasingly given their own tools to create their own experiences and these tools, “within the (even limited) game world have allowed players to engage in their own paidic and playful experiences”.

The rapid development of massive social online communities have been fuelled by the meteoric rise of Social Networking sites such as Facebook (1 billion plus users) (Smith, Segall, & Cowley, 2012), QQ (300 million plus users) (Rossi, 2009), and many, even most, of the current generation of learners are enmeshed in connective technologies (Sontag, 2008).

Bruns (2009) also highlights the core function of these social media communities. These structures form inter-linking and often inter-dependent parts of the broader social media environment. Bruns defines the communities by the adherence of their members to a set of shared values, beliefs, norms and ideas. The community, and specifically the virtual communities formed in modern day online social gaming, presents a key structure that can be analysed in order to understand its impact and role in learning and specifically Organisational Leadership Development initiatives.

Some distinctive features of multiplayer, online games such as team collaboration, problem solving and group decision-making, have caused a lot of interest from practitioners in business, government and the military (for example, see Li, 2004).

Experimental freedom is one of the key aspects that have piqued social researchers’ interest in applying games within the context of personal and Leadership Development (see for example Aldrich, 2005). If one uses the modern day corporation as example, there is a very apparent connection between the modern day business challenges (i.e. increasing compliance rules, large numbers of simultaneous actors, information overload, and an increasingly global focus, with all the complexity that it entails) and the procedural, participatory, encyclopaedic, and spatial elements of modern digital media and specifically digital gaming.
The term “simulation-based training” refers to a collection of training methods, all of which aim at bridging the gap between classroom knowledge and actual practice by placing the learner in realistic situations in the context of which he/she has to bring to bear his/her knowledge (of facts, tasks and procedures, and collaboration strategies) to solve a problem (Brown, Collins, & Duguid, 1989).

Our operational definition of Social Online Simulation Games (SOSG) for the purposes of this study is as follows:

*Online Social Simulation Games is a serious game-based learning approach making use of online social networks to facilitate immersive and socially networked gameplay. These serious games include actors, rules, storylines, resources and simulation elements as building blocks and these socially networked gaming networks can range from a small group to millions of interlinked and interdependent players.*

Our definition is therefore close to what Deterding (2010) would define as “Pervasive Serious Games”.

Various authors have investigated e-competence frameworks such as the European e-Competence Framework 2.0 (Cristobal & Romani, 2009; Lanvin & Fonstad, 2010). These frameworks typically provide a reference framework of ICT competencies that can be used and understood by ICT end-users and supply companies, ICT practitioners, managers and HR departments, the public sector, and educational and social partners. e-Competencies have also been mapped against the Information Management Body of Knowledge (IMBOK) Framework (developed by Bytheway, 2003), linking ICT skills and the broader Information Management process (Mitrovic, 2010).

In our analysis and development of the competency framework required for successful SOSG implementation, we used the European e-Competence Framework (e-CF 2.0) as basis. The primary reason for our utilisation of the European e-Competence Framework as basis for our SOSG framework is the fact that the e-CF 2.0 already attempts to play an integrative role between the various available international frameworks (Lanvin & Fonstad, 2010).

With this study our aim was, through an interpretative methodology and the hermeneutic circle, to produce an exploratory framework for successfully utilising SOSG in Leadership Development within organisations.

**Methodology**

This study adopted a mixed methodology approach with the purpose of creating an initial conceptual framework to answer the research question and sub-questions. The current literature has been reviewed in order to derive a preliminary conceptual framework for the competencies needed for successful implementation of SOSG in organisational leadership training. In our study of the literature, various existing conceptual models and frameworks impacted our thoughts and thus also the suggested mapping of SOSG against the e-CF 2.0 Framework.

Some of these models included the Technology Acceptance Model (TAM and TAM2) (Park, 2009), the Task-Technology Fit Model (TTF); Computer Self-Efficacy Mode; TAM/TTF Model with Computer Self-Efficacy (Dishaw, Bandy, & Strong, 2002); and the Extended TAM model with Flow developed by (Hsu & Lu, 2004). This conceptual framework was further refined utilising the input of an international panel of experts through a two-stage Delphi technique, using an interpretative methodology and the principles of hermeneutics. Quantitative data analysis was conducted to further analyse and refine the data obtained during Round 2 of the Delphi panel process.
According to Lendaris and Geoffrion (as cited in Stitt-Gohdes & Crews, 2004), the Structural Delphi Model allows participants to individually express independent relationships/judgments and are used to produce a group or whole model or system. This methodology assisted in refining the competency framework. The Delphi expert panel process commenced with the development of a set of open-ended questions on the researched issue based on our literature review and its preliminary findings. These questions were then distributed to the panel members individually via a secure online portal.

Dimension 1 of the e-CF 2.0 Framework identifies five e-competence areas, derived from the ICT business processes, namely: PLAN–BUILD–RUN–ENABLE–MANAGE. Dimension 2 of the e-CF 2.0 Framework presents a set of reference e-Competencies for each area, with a generic description for each competence. There are 32 competences identified in total that provide the European generic reference definitions of the e-CF 2.0 Framework.

In Round 1 the respondents were asked to indicate which areas of KNOWLEDGE, SKILLS and ATTITUDES they viewed as important in the process of PLANNING, BUILDING, RUNNING, ENABLING and MANAGING the utilisation of SOSG in Leadership Development programs. The Delphi Round 1 feedback on the open-ended questions was captured and thematically analysed in terms of the agreement with Dimension 1 and 2 of the European e-Competence Framework. Additional competencies identified were noted and integrated. The responses to these questions were summarised into the Pre-Delphi Round 2 Framework and a second set of questions, seeking clarification of areas of agreement and disagreement, was formulated and distributed to the same group of experts.

Panel feedback in the second Delphi round was done by means of a 5-point Likert scale rating (Strongly Agree; Agree; Neutral; Disagree; Strongly Disagree) of the participants’ agreement with the suggested Pre-Delphi Round 2 Framework. The same meta-structure as in the first round was utilised (namely PLANNING; BUILDING; RUNNING; ENABLING; MANAGING).

Findings

In our analysis of the Round 2 panel feedback, a relatively small self-selecting sample (n=10) was used. Our potential application of inferential statistics was therefore limited, and we approached our data analysis fully cognisant of the limits of our deductions. Analysis of the panel feedback was conducted by means of basic descriptive statistics, focusing primarily on analysis of the median as well as measures of dispersion.

In the further analysis of expert panel data as well as the construction of the SOSG Utilisation Framework, we classified the identified competencies into four broad categories:

- **Game Design (GD) Competencies:** Required to ensure player engagement, a Flow experience and the essential integration of elements such as storyline, challenges, reward and user interface.
- **Learning Design (LD) Competencies:** Required to ensure that clear learning goals are set, met and validly assessed.
- **Generic Managerial (GM) Competencies:** Required to ensure that best practices are adhered to in terms of delivery of implementation projects on time and within budget.
- **Subject Matter (SM) Specific Competencies:** Required to ensure that expert thinking is applied to complex, domain specific problems.

For statistical analysis we further categorised respondents into two groups based on their dominant area of expertise: **Serious Games (SG; n=6)** and **Leadership Development (LD; n=4).**
Central Tendency Criteria for identifying Support of Competency was set as Median > 4. The criteria for identifying a Critical Competency was set at Median > 4.5. (See Figure 1)

Our panel of experts presented support for the existing e-CF 2.0 competencies as well as our new competencies. The competency categories suggested, namely LD, GD, GM and SM were also well supported.

The following Critical Competency categories have been identified by the Leadership Development (LD) group:

- Game Design
- Subject Matter Expertise
- Learning Design

The following Critical Competency category has been identified by the Serious Gaming (SG) group:

- Game Design

Significant differences were observed in the opinions of the SG and LD groups of experts on both NEW and EXISTING competencies. There is for example a clear disconnect in the perceived importance that the LD and SG groups attach to the Learning Design and Subject Matter Expertise competencies as critical to SOSG implementations.

These findings suggest a potential disconnect between the two groups of role-players (LD and SG) that are typically involved in SOSG implementations. Cross-training may be beneficial to the SOSG implementation success.

It is our opinion, based on the literature, that each of the competency categories (GM, GD, SM and LD) needs to be present within implementation teams to ensure successful SOSG utilisation.

When analysing the question whether a rating and weighting of more critical competencies can be suggested, the Delphi panel feedback was evaluated per e-CF 2.0 process steps.
Successful Use of Online Social Simulation Games

**Planning**
In terms of the Planning process of SOSG projects, the critical competencies identified by both SG and LD groups were Business Plan Development, Product or Project Planning, Instructional Design, Serious Game Design, Assessment Design and Subject Matter Expertise (specifically Leadership Development expertise).

A competency where a seemingly big disconnect was presented between the SG and LD groups, was Sustainable Development. It is also interesting that neither of the groups particularly valued the technique and competency of Rapid Prototyping’s potential within SOSG planning.

It is furthermore interesting to note that none of the groups viewed Technology Watching as a critical competency within the planning phase. This may present the positive deduction that both groups are sensitive to relying too heavily on over-hyped new technologies. The other possible deduction is that both groups are not particularly focused on remaining at the cutting edge of technical solutions, which may present a negative longer term impact if technology that becomes obsolete very quickly, is implemented. There is not enough data available for us to make a definite finding in this regard and it is suggested that this difference between the groups is studied in further detail.

**Building**
Both SG and LD groups viewed Game Design and Development, Documentation Production, Assessment Construction, and Leadership Development Subject Matter Expertise as critical competencies. The SG group valued Systems Integration and Solution Deployment more than the LD group. This we speculate may be a factor of their typically better experience in dealing with IT-related projects and its systemic integration challenges. The LD group may be less directly experienced in dealing with this issue. It may also present an area where cross-training between project team members may benefit SOSG project implementation success.

The SG group seems to value Experiential Learning Subject Matter Expertise more than the LD group. It may be that SG group members have a higher realisation of the fact that Experiential Learning can be viewed as a distinct field of expertise within Leadership Development. It would be interesting to compare in future research the amount of time and attention given to Experiential Learning within the personal education and training of the typical LD group with that of the SG group. It may very well be that typical SG group education and training put significantly more emphasis on Experiential Learning versus other learning and development approaches.

**Running**
Both SG and LD groups viewed User Support, Change Support, Service Delivery, Project Control Skills and Quality Control Skills as critical competencies. The SG group valued Project Control Skills more than the LD group. The SG group also valued Facilitation Skills more than the LD group. It is interesting that the SG group seems to support the notion that facilitators have a critical role to play even though the project focus is on online gaming.

**Enabling**
Both SG and LD groups viewed Personnel Development as critical competency. It is interesting that neither group seemed to value Information Security Strategy Development. It is furthermore of interest that neither group were viewing the Purchasing and Contract Management competencies as critical. This could be explained by the fact that, within corporate structures, these functions may typically be dealt with by a separate Finance/Procurement Department. It may however present a risk factor to successful utilisation of SOSG in Leadership Development if the imple-
mentation team is not also actively aware of the terms and conditions of procurement and service level agreements relevant to the project.

**Managing**

Both SG and LD groups viewed Continued Assessment of Validity as critical competency. It is interesting that the LD group did not seem to view the Managing competencies as critical. This is a rather surprising finding because in most implementations one would expect the LD group to take the lead in actively managing SOSG projects. It may also be indicative of a perception that the SG group (typically as developers and architects of SOSG) is also responsible for managing its success. In a number of SOSG implementation projects the SG group will consist mainly of outsourced specialists (most organisations, excluding the big corporate organisations such as IBM, do not yet have large in-house SG capacity). It is therefore a significant risk factor for successful SOSG utilisation if the LD group (typically consisting of in-house resources) shifts the responsibility for managing projects to the outsourced SG group.

**Discussion and Recommendations**

The primary research question ascertained the competencies (knowledge, attitudes and skills) necessary for organisations to successfully utilise Social Online Simulation Games as Leadership Development tool. In this regard, we suggested these competencies to be a combination of Game Design, Learning Design, General Managerial and Subject Matter Expertise competencies.

In terms of the sub-questions investigated, it became clear to us that the current technology utilisation frameworks and/or models in literature do not provide an adequate typology of required competencies. These frameworks typically do not take into account the specialised skills (such as Game Design and Learning Design competencies) required for successful SOSG utilisation. Although most of the existing E-CF 2.0 competencies were well supported by panel consensus, various additional competencies were identified as being required for Social Online Simulation Games usage.

Although we were constrained by small sample size and a self-selected sample, we were able to identify an initial rating and weighting of more critical competencies suggested in a form of a framework. We also integrated our findings into an SOSG Framework that can be further tested and refined in practice. Methodologically, a substantially larger expert panel may offer various opportunities for refining the framework and testing the robustness of its basic tenets and structure.

This type of framework may become increasingly valuable to practitioners as easy to use game authoring tools proliferate. It is expected that more and more of these tools will become available and SOSG applications will potentially be developed by Leadership Development experts rather than Serious Games experts.

The analysis suggests that the proposed SOSG Utilisation Framework might form a relatively robust basis for further refinement of the competencies required to implement SOSG in Leadership Development applications.

**References**

Successful Use of Online Social Simulation Games


Biography

Wouter Grové is the CEO of Gamechangers Pty Ltd, a serious gaming and gamification consultancy based in Cape Town. He is program manager: Digital Learning for Leaders, School for Public Leadership, University of Stellenbosch and Project manager: WC CoLab for eInclusion and Social Innovation situated at University of the Western Cape. Wouter is interested in the intersection of the trends of ubiquitous gaming, ubiquitous computing and social networks. His current research focuses on engagement in open innovation projects.
Predicting the Adoption of Video Podcast in Online Health Education

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Abstract

Online Health Education curriculum includes teaching courses to adult learners that pertain to chronic illnesses. In an effort to expose students to practical information, online universities are embedding video podcasts into courses. Research on the effects of video podcasts in online Health Education learning is fairly new. Because of this, there is limited research on its use in Health Education online courses. Furthermore, research that has been conducted is limited to the discussion on the technology itself without regard to theory. With further investigation on the topic in this preliminary study, the researcher wants to learn the diffusion and usage rate of video podcasts in an online Health Education course. In addition, the researcher wants to know if video podcast have a positive impact on students when used in online courses. For this pilot retrospective case study, secondary data was analyzed. Notes were collected on the selection of assignments and the rate of selections. To compile basic demographic data, the quantitative method was used. Qualitative information was obtained from predetermined questions placed in the course for asynchronous responses. Perceived ease of use and compatibility had a positive effect on the use of podcast in online Health Education courses. The findings from this study have the potential to contribute to the understanding of the impact of the use of technology in Health Education courses.

Keywords: video podcasts, online Health Education learning

Introduction

Online Health Education curriculum includes teaching courses to adult learners that pertain to chronic illnesses. In an effort to expose students to “real world” information, online universities are embedding video podcasts into courses.

Problem Statement

Research on the effects of video podcasts in online health education learning is fairly new. Because of this, there is limited research on its use in health education online courses (Burke, Snyder, & Rager, 2009). Furthermore, research that has been conducted is limited to the discussion on the technology itself without regard to theory (Duncan-Howell & Lee, 2007; Forbes & Hickey, 2008; Lightbody, McCullagh, Weeks &
Predicting the Adoption of Video Podcast in Online Health Education

Hutchison, 2006; McGarr, 2009; Van Amelsvoort, 2009).

With further investigation on the topic in this preliminary study, the researcher wants to learn the diffusion and usage rate of video podcasts in an online Health Education course. In addition, the researcher wants to know if video podcasts have a positive impact on students when used in online courses.

Approach

For this pilot retrospective case study, secondary data was analyzed. Notes were collected on the selection of assignments and the rate of selections. To compile basic demographic data, the quantitative method was used. The qualitative research method was applied to the open-ended research questions. Qualitative data was obtained from predetermined questions placed in the course.

Results

Perceived ease of use and compatibility was a positive predictor of the use of podcasts in online Health Education courses.

Conclusion

The findings from this study have the potential to contribute to the understanding of the impact of the use of technology in Health Education courses.

References


Biography

Dr. Grover, PhD, CHES, joined Kaplan in 2009 as part-time online faculty in the school of Health Sciences. Dr. Grover holds a Master’s Degree in Business and Health Care Administration from the University of Phoenix and a PhD in Community Health from Texas Woman's University. She has spent the last 23 years working in various business/professional positions in the health care major hospital. In addition, she has been teaching in the online environment for the past 7 years teaching various bachelors and masters courses in public health, healthcare and health education.

Her volunteer efforts include former CoChair for the American Diabetes Association (ADA) and current member of the ADA Leadership Board. More efforts include member of the Society for Public Health Education’s (SOPHE) 2014 Annual Meeting Planning Committee and 2015 Professional Development Committee member. Writing efforts include a current blog for the US Department of Health and Human Services “Fitness Your Way” blog that began in October, 2010 and a publication on health strategies in the Health Education and Behavior Journal which was published in December, 2010. A book on the effects of diabetes has been published through Amazon.com.
e-Literacy Training in Deep Rural Areas: The Siyakhula Living Lab Experience

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Abstract

Within the discourse of broadband deployment in poor areas (particularly rural), very little attention is generally put on the critical enabler represented by e-literacy training that empowers people to use ICT systems, especially in the form of full-fledged machines such as fixed, tower and laptop computers (These machines are still more preferable for growing a generation of ‘producers’ as opposed to ‘consumers’ in the ICT space.) This paper reports on the experience in running e-literacy in a deep rural area, as part of the Siyakhula Living Lab (SLL), whose end goal is to diffuse production oriented ICTs in poor areas of South Africa and Africa. In particular it will expand on the feedback given by the participants to the last edition of the e-literacy course, run in the first semester of 2014. The lessons learned from this experience include: the need for linguistic localization of the learning material or at least part of its presentation; the importance of teaching and learning that facilitates (easy) transfer of knowledge gained to other ICT settings (such as mobiles; or uses to support business); and the importance of face-to-face courses to allow real interaction with the people living in the targeted areas, partly as a strategic means to forging relations towards the realization of the Living Lab vision (co-creation of solutions with empowered users). Altogether, e-literacy courses have proved to be critical to the broad aim of SLL of ‘activating’ the segment of society living in poor areas towards self-determination. A small but telling indicator is the transformation in the view people have of themselves once certified as e-literate.

Keywords: e-Skills, e-Literacy, Education, Siyakhula Living Lab, Mobile, Rural

Introduction

In today's world, we have come to accept that digital or e-literacy is as important as other forms of literacies. That is, unlike years gone by, we recognize that “to be a full citizen, several literacies have to be mastered: basic literacy, media, technological and informational” (Peña-López, 2009).

Without these multiple literacies, efforts aimed at (re)activating marginalized segments of society towards self-determination and development would fail. The Siyakhula Living Lab (SLL) - a long term Information and Communication Technologies for Development (ICT4D) project - works in fulfilment of
realizing this very goal in the poor areas of the Eastern Cape in South Africa (Siyakhula Living Lab, n.d; Terzoli, 2010). This being the case, SLL foregrounds the importance of combating illiteracy of all kinds, as part of its strategy to minimize failure and because, at a fundamental level, the operations of SLL are rooted in the belief that ‘education is the cornerstone of development’ since whether formal or informal, education engenders the criticality that is essential for successful co-innovation and co-creation of appropriate solutions.

In this paper, we share our multi-year experience in running e-literacy trainings within SLL in an effort to contribute towards the computer literacy shortage problem in South Africa. Part of this initiative is to ensure that community members have the necessary e-literacy skills which may be defined as “the capabilities needed to be socially appropriate ICT for local development” and for participating in the Knowledge Economy (Mitrovic, 2012). We believe that success towards having communities that are digitally proficient lies, in part, in using traditional pedagogic methods that put emphasis on incremental learning and linkages of knowledge in the absolute sense of fostering the ability to solve problems and innovate using ICTs.

Our belief is rooted in our general experience as teachers but also on a conceptual understanding akin to the one depicted in Figure 1 by the European Computer Driving Licence Foundation (ECDL, 2011) and further articulated by the Ikamva National e-Skills Institute of South Africa (iNeSI) (iNeSI, n.d.; Mitrovic, 2012). In essence, to get individuals and/or communities proficient, we first cultivate ‘digital awareness’, and in a slow, methodical manner we journey into developing ICT skills and knowledge that hopefully would lead to competency—or, as summarized in the figure, we employ a training strategy that starts with awareness and in time, as interaction increases leads to increasing proficiency in the use of ICTs.

The journey to getting, in particular, poor communities in rural areas competent in the digital space is a formidable task. It is a complex affair for a number of reasons that stem, on the one hand, from the geographic location, which complicates, for example, logistics in organizing trainings. On the other hand, the reasons relate to having to operate in a context fraught with markers for exclusion in our society: poverty, unemployment, poor education together with other forms of inequality in South Africa’s dual economy.

We are aware of many initiatives that have e-literacy aspects in South Africa (such as the Digital Doorway (Gush, 2010), the large experiment in Cofimvaba (Ford, 2014) and above all the work by the iNeSI). This paper, however, will concentrate on our direct experience within the Siyakhula Living Lab, using the most recent evaluation of the literacy training by SLL community. The purpose is to contribute, practically, to the South African ICT policy recommendations through addressing the question of what can be done towards resolving the ICT skills shortage in South Africa based on the technology currently available.

The rest of the paper is structured as follows. The next section introduces the SLL. The third section is an overview of the e-literacy training run in the SLL since 2006. The fourth section reports
on the results of a survey administered to the participants of the 2014 (first semester) edition of the course. The fifth section discusses the lessons learnt and the final section concludes.

**Siyakhula Living Lab**

The SLL is part of a larger ICT ecosystem for marginalized communities, and was initiated at the end of 2005 by the Telkom Centres of Excellence in Telecommunications at the University of Fort Hare and Rhodes University. Its main field site is in a deep rural part of the Eastern Cape Province, in the vicinity of the Dwesa Nature Reserve. Its location is illustrated in Figure 2a.

![Figure 2a: Location of the Siyakhula Living Lab main site in Dwesa](image)

The SLL promotes the diffusion of ICTs in poor areas (rural as well as peri-urban). In its main site, a IP network, realized with wireless and wired technologies, currently connects seventeen access points (Digital Access Nodes, DANs) based at schools, forming what we call a ‘broadband island’. The broadband island is in turn connected to the Internet via two satellite links, with a download speed of 512kbps and 1Mbps (Dalvit, 2011). A geographical view of the network is shown in Figure 2b, where the inter-DAN links, in yellow, are realized through WiMAX technology which theoretically has an average bandwidth of 70 Mbps (Chilgireddy, 2014).

![Figure 2b: The Siyakhula Living Lab Network (Siyakhula Living Lab, n.d.)](image)
Within each DAN, a computer laboratory with a variable number of user terminals is present, normally in a thin-client configuration. The operating system of choice is Edubuntu (of the Linux family) and productivity and educational software suites are all of a Free and Open Source Software (FOSS) nature. The network and the DANs are setup and maintained by researchers from Fort Hare and Rhodes, with the support of their industry partners and community champions (Gumbo, Terzoli, & Thinyane, 2013).

Very importantly, each Digital Access Nodes (DANs) is open to the members of the community surrounding the school.

Providing computing infrastructure and Internet alone, as important as it is, is just the start. Besides training which forms one of SLL’s main activities, and will be expanded on in the next sections, there is the need to address the potential of deployed ICTs through the development of appropriate e-services, for example to facilitate government transactions (Fassil, 2009; Gumbo, Terzoli, & Thinyane, 2013). Also, it is crucial to find ways to sustain the infrastructure, which has a cost that is beyond the resources directly available in deep rural communities. The two needs have stimulated much research activity within the SLL, which is made concrete by an artefact currently in the making, TeleWeaver (Reed House Systems, n.d.).

TeleWeaver is an e-service integration platform, coupled with a billing engine. Services can range from e-commerce support to sell local products and services (from beading to micro-tourism); to support for preparing a Curriculum Vitae in response to a job advertisement, possibly found through another service in TeleWeaver - the Career service; to support of interaction with governmental entities at various level (ID requests and tracking or child grants from the Department of Home Affairs, for example); to support for surveys in the community; to support for pre-paid services. (The applications listed are just a small subset: the idea is to have tens and then hundreds of services over time) (Terzoli, 2013).

Each application running in TeleWeaver will in general be a source of revenue, either from the local users (for example, preparation of a CV) or, more importantly at first, from an entity outside the community (for example a buyer of online goods and services from the community; or a department such as Department of Home Affairs, which might want to pay to reduce the presence of physical offices for the operations made possible by TeleWeaver). The revenue per single application will not be large: but the sum of the revenues has the potential to be substantial. This, by the way, is the reason for the name, TeleWeaver: revenue streams are ‘woven’ together until they become important and are able to support the ICT infrastructure, exactly as reeds are woven together to make artefacts much stronger than any single reed (Terzoli, 2013).

SLL relies on user involvement for the building of systematic use cases and requirements analysis, in a full user centered approach and towards co-creation of solutions (Gumbo, Terzoli, & Thinyane, 2013). As part of the user-centred approach to facilitate the use of the DANs, internet, developed e-services and basic community e-literacy has been conducted by the university researchers (and later community champions) since 2006. While the details of logistics and content involved have evolved over time, they have remained relatively constant since 2012. The next section describes in general the e-literacy training as conducted over the years, and the following sections give the course overview and feedback of trainees in the first edition of the 2014 e-literacy training, as supported by the iKamva National Skills Institute (iNeSI), Eastern Cape CoLab and Makana Apps Factory (MAF), from February 2014.

**E-Literacy Training**

SLL offers a free, attendance and competence certified, e-literacy course, delivered by the university researchers to the SLL community, to properly activate and enhance the use of the SLL ICT infrastructure and broadband, and also, to facilitate ICT user driven innovation. This course is
hosted at two of the largest DANs, in order to accommodate all seventeen schools over two weeks per month.

**Content**

The content for the SLL e-literacy training course enables basic exposure and a foundation to computer technology and FOSS, as illustrated in Figure 3. This course is packaged and printed as four modules, briefly described in Table 1. The course includes games and an adaptation of five of the seven Core Modules in the International Computer Drivers Licence (ICDL) certified course (International Computer Drivers License, n.d.). The trainees are also encouraged to practice over a wide range of devices, beyond those located in the DANs, in order to activate other competencies, such as advance use of mobile phones (Gumbo, & Terzoli, 2013).

![Figure 3: An EduBuntu computer game which forms part of the Introduction to Computers](image)

**Table 1: SLL e-literacy training modules**

<table>
<thead>
<tr>
<th>Module Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Introduction to Computers and Managing Files</td>
<td>Computer navigation and familiarization of desktop computers and EduBuntu. Creating folders and saving files.</td>
</tr>
<tr>
<td>Word Processing using Open Office Writer</td>
<td>Main operations and formatting options in a Word Processor, using Writer as the example.</td>
</tr>
<tr>
<td>Spreadsheet using Open Office Calc</td>
<td>Main operations and formatting options in a spreadsheet, using Calc as an example.</td>
</tr>
<tr>
<td>Using the Internet</td>
<td>Introduction to the internet; navigation through different web pages, using the Google search page as a starting point; opening an email account (normally the first one) and using it.</td>
</tr>
</tbody>
</table>

In addition to the e-literacy course outlined above, an opportunity for SLL educators to enroll in more formal programme called Advanced Certificate in Education (ACE) in ICT came about through the collaboration of the Department of Education, Rhodes University and the SLL in 2009. Pre-ACE was held at Ngwane JSS, one of the seventeen SLL schools, and consisted of twenty educators from various schools, within and beyond the network. In this way, the SLL presented the educators with an evolution to the traditional schooling system, through an innovative education and learning strategy that saw educators trained in their local environment for the first time as opposed to universities (Dalvit, 2011).
**Structure**

Since 2012, the SLL has used two DANs for e-literacy training. At the beginning of 2014, there was a plan to use three DANs. However, due to the rationalisation of all schools in the former Transkei region, the third school had to start extensively using the DAN as a classroom. On the other hand, one of our five seater DANs was upgraded to a twenty-four seater in August 2014. It will be used as an additional e-literacy training centre in the second semester of 2014.

Each day’s training session consists of teaching and a practical demonstration by the researchers and an exercise session for the trainees, over three hours. In total, approximately sixty hours of contact time is required to complete the course. During the course trainees have to demonstrate their skills of basic web-based browsing, text entry and text formatting skills, through emailing completed exercises to the main author for assessment and feedback. As a result, the certification is not only based on attendance, but also the submission of completed exercises to validate operative capacity of trainees.

e-Literacy course planning is done through workshops with representatives affiliated to the seventeen schools (principal, educators and community member per each school). Through these workshops, we determine what the communities see as their ICT requirements and also researchers and community members discuss potential literacy training logistics issues. For example, unforeseen incidents such as flooding rivers, technology failures, problems with transport from the community and the university side are discussed, so that everybody will try to minimize them. Ad hoc adjustments of the drafted schedule can still be necessary over the duration of the e-literacy training course. These adjustments are typically communicated via smses and, where possible, instant messengers like WhatsApp. These discussions form the basis of the evaluation given by literacy training attendees in later sections. A smaller SLL community committee, the ‘executive committee’, follows up with specific schools / communities if it appears that there is a decrease in course attendance.

**Trainees**

At the moment the e-literacy courses are open to four members of each of the seventeen DANs at a time. We accommodate community members (often unemployed, youth, elderly, economically challenged individuals) and educators from schools within the network, to distribute the training geographically and socially. There is a need to control the number bias towards educator’s enrollment by insisting that community members be included to reduce the divide which might result from the employed educators who have access to ICT resources improving their skills, while the community at large falls behind. The main incentive for course attendance is based on the fact that basic office applications and internet use is a new experience for individuals from the SLL communities and beyond.

**Trainers**

To conduct e-literacy training, researchers from the two universities are required to become familiar with the Eastern Cape rural context, through studying and residing, at least for short periods, in the rural environment (a week at a time). Trips depart on Sunday, for the researchers to be on site from Monday to Friday while keeping in constant contact with the project lead, and through her, whoever else has the expertise with the solution of a specific problem in the field. The literacy training sessions require about six trainers, so that there is adequate presence (which ideally includes a proficient Xhosa trainer) at the two training DANs.

Beyond conducting e-literacy training, it is useful for the researchers to be able to troubleshoot ICT problems encountered on site, though at times specific ‘technical’ trips are necessary. Figure 4 illustrates a SLL trip dedicated to networking.
The e-literacy training interactions are relevant to the researchers for their specific research task (often in the form of a thesis). They use the opportunity of the e-literacy course to build relations, conducting requirements and needs assessments, and use-cases using interviews, questionnaires and focus group discussions (Siyakhula Living Lab, n.d). These week-long e-literacy session then become crucial to build a real interaction between researchers and SLL communities through involving researchers, schools and communities in one well focused, purposeful interactive activity.

2014 e-Literacy Training Feedback

The following sections are based on the impact of ICT e-literacy on human resource development in the SLL communities, based on the opinions of individuals who attended the training sessions, and completed the course successfully. The results presented in this section are based on feedback from the 2014 e-literacy course trainees (first semester), a mix of educators and community members. The questions used to provide this feedback also serve as a response to the questions which were raised in the SLL planning workshops prior to the literacy training sessions.

The gender distribution of the trainees who completed the training is shown in Figure 5. Of the 35 trainees, 7 were male, 28 were female. Initially 40 people were enrolled in the course. The community champions, who assist with the nomination of trainees have an even gender distribution, but the results show that the majority of people who attend the session in 2014 were female. These numbers accurately depicts the average gender distribution and activity in SLL over the years, since inception.

We captured the age distribution of the trainees who attended the training sessions as shown in Figure 6. These ranged from 18 years to almost 60 years. This illustrates how ICT is perceived as relevant in all age even in a rural context, although the highest attendance is represented by the youth.
There was a mixed reaction to the question ‘Do you think ICT training is easy or difficult?’, as shown in Figure 7. While the majority of respondents responded that it was easy, a sizeable number responded that it was difficult. While the option of ‘average’ was intentionally not offered, some of the respondents decided to add it, as shown in Figure 7. So it would appear that the course is tuned acceptably to the capacity of the audience.

Figure 8 illustrates what the trainees understood as the advantages of attending e-literacy training sessions, towards the end of their course. The question was open, with strong clustering of the answers. The responses show an appreciation towards free ICT, targeted to the improvement of rural life. Possibility of finding a job (or a better job) is a close second, while the reward of knowing more is in a good third position. Interesting are the answers that see the exercise as a good for community building, though only about 10% of the respondents offered that as an advantage.

The e-literacy sessions were not without problems, as shown in Figure 9. A large number of trainees highlighted how they would prefer these modules to be conducted in Xhosa, which is the predominant language in the Eastern Cape province. The second challenge was the travel by the community members to reach the venues for the training. (Although the travel is a challenge for the researchers as well, Dwesa being about 280km from FH (institution 1), and 330km from RU
(institution 2), we are here focusing on the local travel by trainees.) Indeed, some of the trainees had to travel up to about 40km on rather bad gravel roads. The answer regarding chairs might be surprising, and of course is not widespread: chairs are indeed a problem in rural schools unless appropriate ‘innovations’ are brought it.

![Figure 9: Problems encountered during e-literacy training](image)

At the end of the survey there was a request for suggestion to improve the course. The responses are illustrated in Figure 10. An interesting point to note is the balances ‘debate’ between free vs paid e-literacy courses. Another is the awareness of the nature of the ICT intervention, which targets the entire community, even if it is located in schools, and the suggestion to push that side further.

![Figure 10: Suggestions for e-literacy training](image)

**Discussion**

The study reported in the previous section was run at the end of a 4-module e-literacy course in the Dwesa site of the SLL, which concluded at the end of the first semester of 2014. This section will use it as a springboard for a discussion on e-literacy courses in the Siyakhula Living Lab in general, integrating the experience gained from previous years. For this privileged vintage position to matter, however, we must be in “true solidarity” with the communities, as expressed by Freire (2000) in his classic text, ‘Pedagogy of the Oppressed’, which might assist in articulating experience gained and validating responses.

The gender distribution witnessed in the 2014 (first semester) edition is fairly typical of previous years. Contributing to this are two obvious facts: a portion of the course participants are educators, a profession in which female presence is prevalent, at least for this particular community (based on the course attendees information in our possession); and it is easier to have women in the community that are unemployed and so can attend the course. To this, however, one should add the fact that the stereotype very common in western settings, which associated mostly men to
technology and so computers, does not seem to be as common in the community in which we are operating. We as SLL endeavor to maintain a strong female presence in e-skills courses (and not just at literacy level).

The responses on the advantages of attending the e-literacy course reflect widespread perceptions in the area as well as the core problem, which is unemployment. So, besides highlighting the fact that it is free (which is per se an advantage, both of short duration), the focus is on the increases chances for a job. We have on record individuals from Dwesa that have started money making activities on the strength of being e-literate (and have access to the Internet through the DANs), but the phenomenon is still in its infancy. The fact is, however, that people sees, correctly, any improvement of their knowledge base, especially in connection with ‘modernity’, as a step that moves them closer to a job. The request of some form of certification at the end of the course is a reflection of this.

Seeing community building as an advantage of the e-literacy course has to do with at least two aspects of the SLL activity. First of all, the learning is communal and in a communal setting: different from the way learning of ICT is often (incorrectly) represented. Communal learning is not just more cost effective, but it is generally better when very new paradigms and ideas are proposed, as it is the case of ICT in a deep rural setting. An interesting side-effect in the context of easing the introduction of new paradigms, was noted when SLL realized that people that had Internet enabled cellular phones started using them for Internet access after the e-literacy courses and not before (Gumbo, & Terzoli, 2013). Secondly, there is community building in the fact that our operations, and especially the e-literacy courses, open the schools to the communities around them, reinforcing the link that should exist (but often does not) between schools and the embedding society.

Most teaching is predicated on a language, and e-literacy is no exception in the SLL setting. Indigenous languages are critical in the interaction during the introduction to ICTs, although electronic resources such as computers, tablets or cellphones often require, currently at least, the use of basic English. (This is due to the slow speed at which localization is taking up in South Africa, in part exactly due to the lack of e-skills.) The practice shows us that Xhosa would be ideal all through the course, though SLL is faced with two problems. The first while SLL has produced a reduced version of the course material in Xhosa and has an ICT English – Xhosa glossary (Sam, 2010) not all material is yet available in Xhosa. The other, more serious, is that only some of the SLL tutors are able to speak Xhosa, and the situation is not likely to change anytime soon, based on the demographics of researcher enrollment over the years. Of course, the second constraint falls away when the courses are given by local ‘champions’ and later simply by members of the community. Certainly, localization, not only of teaching materials but of the applications interfaces, is one of the foci of the activity of the SLL (Gumbo, 2012).

An issue always surfacing with SLL e-literacy courses is whether they should be free or not. It is a common experience that often what is paid for is held in greater regard than what is free. The discussion is certainly ongoing, but the practice adopted in the SLL currently is that courses provided directly by the Fort Hare and Rhodes team are free, while the ones offered by the community can be for a fee. An interesting proposal by a member of the community is that the access to courses run by the Universities should be linked to the payment of a deposit, which is refundable on the successful completion of the course. This would increase attendance, which is crucial during e-literacy training but not a fully solved problem. (As an aside, it is not uncommon for a community member to feel they deserve a certificate despite not being present at some of the classes, or enquire about class when the course is well underway.)

Logistical difficulty is almost by definition connected to rural areas, and makes ICT a particularly good fit to solve rurality problems. This is particularly true for areas such as the former Transkei,
where even the concept of a ‘village’ is almost absent. Coupled with very sparse distribution of the population, the road network is very underdeveloped. (For example, in the full area covered by the SLL DANs in Dwesa, there is not even a meter of tar road or a single proper bridge over the streams. The gravel roads are in a terrible state due to continuous erosion due to the seasonal rain.) One of the reasons to locate the public access points in schools is exactly to try and reduce the travel needed to reach a DAN. Unfortunately, at this stage, not all the available DANs are the same for the purpose of e-literacy: some only have enough end-user terminals to be able to run courses for a reasonable number of people. Besides that, there are limitations on the number of people that could do the teaching, though that limitation is reducing with the increase of the e-literate people in the area who have responded well to the course and have the capacity to teach others.

The “chairs problem” (Figure 9) illustrates something important - besides the obvious point of the importance of preventing chairs from disappearing or being of bad quality and so break easily. The lesson here is that without real engagement with a community, it is difficult to forecast what the real problems in the community are, and even more so how to fix them, no matter how trivial the problem, or the fix, is. This observation is at the core of the Living Lab methodology. Figure 3 illustrate the SLL solution to this specific little problem. The solution, which utilizes outdoor picnic tables as the main element of furniture for the DANs, has other advantages, including the comparatively low cost and the long life span.

One final aspect of the SLL e-literacy courses is its fundamental contribution to the realization of the Living Lab research paradigm (Cunningham, 2011), something which is essential for SLL to search of sustainable ways to diffuse ICT in poor settings. This contribution happens in two manners. The first one is rather direct: to be able to co-opt the people living in the area covered by the Living Lab, SLL needs them to be able to understand what an e-service is, what the Internet is etc, and not just in a ‘theoretical’ manner but in a practical one, with meaning for their everyday lives. The second is more subtle, but as important. To be able to be co-opted in the creation of new solutions to local problems, it is necessary to have the belief that one can actually contribute to the solution of a problem. This is a formidable mind shift, especially for people living in deep rural areas, faced with the interaction of ‘outsiders’ that show technology competence in an area that is completely new to them. What SLL has witnessed is that this mind shift can happen as the result of the e-literacy course, possibly linked to the sense of self-fulfillment linked to having mastered something that was seen as foreign and beyond one’s possibilities. Provided, naturally, that the ‘outsiders’ (the trainers) runs the courses recognizing the trainees as peers, who simply don’t have specific knowledge about an area but in exchange will have other knowledge in other areas.

**Conclusion**

Digital literacy now counts among the other basic literacies that are essential for meaningful participation in the modern society (Peña-López, 2009). As such, all efforts aimed at facilitating the acquisition of relevant digital skills and knowledge via various forms of education and training are important—by virtue of empowering individuals, they hold the potential to ‘activate’ them into reclaiming their agency within the big picture of addressing unemployment, poverty and other kinds of inequality.

In this paper, we shared some aspects of our multi-year experience in conducting trainings for building digital competency skills in a deep rural area of South Africa. While SLL regards its training successful, more should be done and appropriate resources should be provided as matter of urgency to give e-literacy courses a wider reach, even simply because of the sense of hope and increased sense of self determination that SLL records among the people attending the e-literacy
courses for being able to master what is still regarded an almost impossible technology in rural areas.

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**Biography**

**Sibukele Gumbo** is the Project Lead of the Siyakhula Living Lab Management Unit and the Research Assistant in the University of Fort Hare Telkom Centre of Excellence. Her main areas of academic interest are in ICT for development, Java programming and computer networking. Sibukele holds an MSc in Computer Science (cum laude) and is currently a Doctoral candidate in the Computer Science Department at the University of Fort Hare.

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Alfredo Terzoli obtained a Laurea cum Laude in Physics from the University of Pavia, Italy. He is currently the Head of the Telkom Centre of Excellence in Distributed Multimedia in the Computer Science department of Rhodes University and Research Director of the Telkom Centre of Excellence in ICT4Development, hosted at University of Fort Hare.

His main technical research interest is the building of advanced telecommunication services that merge real-time and non-real-time multimedia streams, in converged networks. He also has a strong interest in ICT for development, where he started and leads a multi-disciplinary, long term, cooperative research project sited in Dwesa, in 2006. The project was re-organized in 2008 as the Siyakhula Living Lab. In 2010, the project was complemented by the start of a software factory, Reed House Systems which is ‘productizing’ and commercializing the innovations realized in the Siyakhula Living Lab.
Managing Cognitive Load When Teaching and Learning e-Skills

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Abstract

The paper introduces major categories of cognitive load imposed on learners in instructional situations and provides examples of methods for managing different types of load when teaching and learning such e-skills as using new software manuals and using spreadsheets. It describes three series of studies within a cognitive load framework that illustrate methods for reducing unnecessary, wasteful extraneous cognitive load (split-attention and redundancy effects), managing essential, productive intrinsic cognitive load (pre-training and isolated elements effect), and appropriately focusing working memory resources by enhancing germane resources (imagination effect).

Keywords: cognitive load, split-attention, redundancy, pre-training, isolated elements technique, imagination technique.

Introduction

According to cognitive load theory, two major components of our cognitive architecture that are critical to learning are long-term memory and working memory (for overviews of this architecture and cognitive load theory, see Kalyuga, 2011, and Sweller, Ayres, & Kalyuga, 2011). The permanent knowledge base in long-term memory is critical in most of human cognitive activities including learning. This organized knowledge base could be conceptualized as generic knowledge structures (schemas) representing concepts and procedures that allow us to categorize problem situations.

Working memory is another major component of our cognitive architecture that, according to the above model of human cognitive architecture, represents a mechanism that limits the scope of immediate simultaneous changes to the knowledge base in long-term memory that may potentially inhibit its functionality (Sweller et al., 2011). Working memory is also associated with conscious processing of information within the focus of attention. Its processing capacity and duration are severely limited to only several units of information at a time when dealing with novel information (Cowan, 2001; Miller, 1956). Had the number of new simultaneously processed elements of information not been limited by the capacity of working memory, effective decisions in new situations would have been unlikely because of an overwhelming combinatorial explosion caused by the need of considering all possible interrelations between many elements.
Managing Cognitive Load

From this perspective, the importance of the learner organized knowledge base in long-term memory is primarily determined by its ability to effectively reduce the capacity limitation of working memory by encapsulating many elements of information into higher-level chunks that could be treated as single units in working memory (Ericsson & Kintsch, 1995). Learners with higher levels of prior knowledge heavily rely on this mechanism in order to reduce their cognitive load. Another critical means of reducing cognitive load is the automation of basic procedures to the point at which they do not require any controlled conscious processing in working memory.

Cognitive load theory distinguishes two major types of cognitive load that must be managed in any learning situation. Extraneous cognitive load is the burden unnecessarily imposed on working memory by poor instructional design. Ideally, this load should be eliminated or reduced as much as possible to enhance learning. Intrinsic cognitive load, on the other hand, is essential for learning load caused by the innate complexity (levels of interactivity or interconnectedness between the elements of information) of the instructional material relative to the level of learner prior knowledge. This load needs to be appropriately managed (reduced or increased depending on the magnitude of total cognitive load and available working memory resources). An efficient instructional design needs to keep the total of the extraneous and intrinsic cognitive load below the capacity limits of working memory allowing effective learning to take place. Working memory resources actually allocated by the learner to dealing with productive intrinsic cognitive load are defined as germane resources or germane cognitive load (Sweller, 2010).

The following sections of the paper describe three series of studies within a cognitive load framework associated with the acquisition of e-skills (e.g., learning new computer software from manuals or learning how to use spreadsheets) that illustrate methods for reducing unnecessary (wasteful) extraneous cognitive load, managing essential (productive) intrinsic cognitive load, and appropriately focusing working memory resources (enhancing germane resources).

Reducing Extraneous Cognitive Load
(Split-attention and Redundancy Effects)

The split-attention and redundancy situations can be found in many instructional materials used in learning e-skills. For example such situations could be created by manuals that come with various software products from which many e-skills are acquired in the first place (either in printed forms or presented as on-screen instructions). These manuals usually require following the instructions immediately on the actual computer thus causing learners to split their attention between the manuals, computer screen and keyboard. The associated search-and match processes may result in a heavy extraneous cognitive load that do not contribute to learning but consume limited working memory resources.

In addition, using the diagrams of a computer screen in the manual and the computer itself may generate a redundancy effect because of the need for learners to process the redundant source of information. Eliminating the computer and using only the diagrams of the computer screen and keyboard with physically integrated textual explanations could be an effective technique during the initial stages of instruction. Sweller and Chandler (1994) and Chandler and Sweller (1996) demonstrated benefits of learning from such manuals with integrated diagram and text instructions without using the actual computers for technical apprentices who showed superior performance and reduced learning times compared to their peers learning from traditional instructional materials with computers. Even more importantly, these learners performed better not only in written but also in practical skill posttests despite the absence of any practical exercises with actual computers before the tests. Cerpa, Chandler, and Sweller (1996) also demonstrated that placing instructions only on a computer screen was more effective than having them on the screen and
in a manual simultaneously because of the extraneous cognitive load caused by redundant information.

It should be noted that the complexity of learning materials (high levels of element interactivity) is an essential factor of this effect (as most other cognitive load effects). Only for such complex materials, an additional extraneous cognitive load caused by processing redundant information could exceed working memory capacity limits. For simple materials, the resulting cognitive load may still be within working memory limits and not interfere with learning (Chandler & Sweller, 1996).

Thus, temporarily eliminating computers at the initial stages of learning particular software skills and using self-contained manuals could facilitate acquisition of these skills for novice learners. Alternatively, placing all the relevant information on the computer screen instead of the manual may also be an effective approach (computer is used only as a page-turner in this case). During the following stages of learning, the computer could be used for performing or practicing the relevant skills, since the learners would acquire some knowledge by that time that would enable them to cope with higher levels of cognitive load.

Managing Intrinsic Load
(Pre-training and Isolated Elements Effects)

High levels of intrinsic cognitive load are caused by interconnected elements of information that must be processed simultaneously in order to be understood (i.e. materials with high levels of element interactivity). The required cognitive resources for processing such information may exceed the available working memory capacity, especially for novice learners who need to process simultaneously all the individual elements of information and their connections in working memory. While extraneous cognitive load could be reduced by using appropriate instructional design techniques, changing intrinsic load requires changing the whole learning task or changing the level of learner prior knowledge. The learners with higher levels of domain specific knowledge are capable of processing a larger number of interacting elements simultaneously without a cognitive overload because they can incorporate many such elements into a single chunk that could be treated as a single element in working memory.

Since intrinsic cognitive load always depends on learner levels of prior knowledge, one obvious method of reducing intrinsic load is to develop specific prerequisite knowledge before the main instructional materials are presented. This method is often referred to as pre-training. For example, Clarke, Ayres and Sweller (2005) investigated the effectiveness of pre-training basic spreadsheet skills that were required for learning specific mathematical concepts (graphs) and found that students with low knowledge of spreadsheets benefited from such pre-training compared with students who were simultaneously dealing with the spreadsheets and mathematical concepts. However, the technique was redundant for more knowledgeable learners who already had many schemas associated with spreadsheets. Thus, the effectiveness of the pre-training method depends on levels of learner prior experience in the corresponding domain.

Blayney, Kalyuga and Sweller (2010) investigated the effectiveness of altering the nature of the task (an isolated-elements method) with undergraduate university accounting students learning how to construct spreadsheet formulae for basic accountancy concepts. Initially, two groups received either isolated-elements (intermediate sub-calculation steps with fewer interacting elements had to be entered in separate spreadsheet cells before they were combined in a single cell) or interacting-elements instructions (the whole formula consisting of several sub-calculation had to be entered within one spreadsheet cell). This phase was followed by fully interacting elements instruction identical for both groups. The study demonstrated that for low-knowledge learners, using the initial isolated-elements technique was more effective than the fully interacting ele-
ments approach, while for more knowledgeable learners, there was no difference between the two methods.

It was suggested that the initially reduced task complexity by replacing the whole, fully interactive task by a number of less complex isolated components reduced intrinsic load at the beginning and allowed novice learners to acquire some partial schemas that eased working memory limitations during the following phase of instruction. As for the more knowledgeable learners, they already had similar schemas for handling higher levels of intrinsic load from the beginning and did not need the above technique. Blayney, Kalyuga, and Sweller (2014) demonstrated that task complexity interacted with both levels of element isolation and learner levels of expertise: expertise and complexity have countervailing effects.

**Enhancing Germane Resources (Imagination Effect)**

In order to increase working memory resources actually allocated by the learner to dealing with intrinsic cognitive load (i.e. to increase germane resources), students could be asked to imagine the procedural steps involved in a specific e-skill rather than continue to study the description of such steps. For example, Cooper, Tindall-Ford, Chandler, and Sweller (2001) applied this idea to the instruction on how to use a spreadsheet application. After studying a set of diagrams on a computer screen with embedded textual explanations of sequential steps, students were directed to turn away from the screen and imagine the steps of the procedure. The study showed that imagining a previously studied procedure was more effective than studying again the same procedure (an imagination effect), but only for relatively more knowledgeable learners: the technique was not effective for novices.

It was suggested that imagining a procedure required its processing in working memory. The available relevant knowledge structures allowed the more experienced learners to process large amounts of familiar information in working memory, and the imagination procedure directed their cognitive resources to the essential interacting elements of information. On the other hand, since working memory is very limited for novice learners, imagining a novel procedure might generate an excessive cognitive load for these learners. Studying the description of the procedure could better assist these learners in initial knowledge construction. In line with this assumption, Ginns, Chandler, and Sweller (2003) demonstrated that university students learned new for them HTML code more effectively by repeatedly studying worked examples of the corresponding procedures rather than imagining these procedures.

**Conclusion**

Many instructional materials and procedures used in teaching and learning e-skills could cause learner cognitive (working memory) overload. The paper provided examples of instructional methods developed within a cognitive load framework for reducing extraneous cognitive load, managing essential intrinsic cognitive load, and appropriately focusing working memory resources (enhancing germane resources) while teaching e-skills related to learning new computer software from manuals or learning how to use spreadsheets. These methods could possibly be effectively used in learning and instructing many other types of e-skills, however, research studies in their applicability in various specific areas of e-learning still need to be conducted in the future.
References


Biography

Slava Kalyuga is Professor of Educational Psychology at the School of Education, the University of New South Wales, Australia where he received a Ph.D. and has worked since 1995. His research interests are in cognitive processes in learning, cognitive load theory, and evidence-based instructional design principles. His specific contributions include detailed experimental studies of the role of learner prior knowledge in learning (expertise reversal effect); the redundancy effect in multimedia learning; the development of rapid online diagnostic assessment methods; and studies of the effectiveness of different adaptive procedures for tailoring instruction to levels of learner expertise. He is the author of three books and over 90 research articles and book chapters in this area of research.
Evaluating the Utility of a Knowledge Acquisition and Construction Framework for Learning Management Systems

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Abstract
Virtual Learning Environments (VLEs), also known as Learning Management Systems (LMSs) are being implemented by many higher education institutions in response to the increasing demand for online teaching and learning. Open source software platforms such as Moodle, Sakai and Claroline are among the most commonly implemented approaches. This paper offers a comparison and evaluation of some of the popular VLEs/LMSs and on the strength of such analyses, establishes the desired properties of a LMS to organise the learning process in Open and Distance e-Learning (ODeL). Following this, the extent to which a previously developed Knowledge Acquisition and Construction framework of the authors adheres to an ideal LMS, is evaluated.

Keywords: Constructivism, framework, Learning Management System, myUnisa, Moodle, Open and Distance e-Learning (ODeL), online, Sakai, Virtual Learning Environment.

Introduction
With the rapid advances in Internet technology and the world-wide web, higher education institutions have increasingly shifted their teaching and learning foci to open and distance e-learning (ODeL) and the accompanying online technologies (Guri-Rosenblit, 2009). In order to manage the multitude of technologies available to e-learning providers, Learning Management Systems (LMS) (there are more than 250 LMS on the market) have been developed during the past fifteen years as platforms to handle student registrations; course management and delivery; assessment; and reporting (Bri, Garcia, Coll, & Lloret, 2009). The target market includes multinational corporations, universities and government agencies. Bri et al. (2009) also report that a good LMS can, amongst other, increase the productivity of instructors and managers, improve on learning results and reduce costs of compliance.
In 2004, the University of South Africa (Unisa) (http://www.unisa.ac.za) took a decision to migrate from previous disparate Learning Management Systems to a new integrated Learning Management System that was branded ‘myUnisa’. Subsequent to this decision, the Sakai Framework was adopted in June 2005, and six months later, user testing, based on this platform, was in progress (Myburgh & Sithobe, 2006). The myUnisa e-learning environment has evolved steadily over the past 8 years up to what it is now, and it continues to evolve into the future as it adapts and incorporates changing circumstances. The myUnisa system is available to registered students at https://my.unisa.ac.za/.

According to Liebenberg, Chetty, and Prinsloo (2012), 282 248 students had access to the myUnisa e-learning environment in 2011 out of a total of 328 179 registered students. The myUnisa e-learning environment consists mainly of teaching and learning tools among other features. The university encourages such environment to be the primary and official means of communication between lecturers and students, e-tutors and students, and among students themselves. An e-tutor project started in 2013 and each new student is linked to an e-tutor at registration (Van Schoor, 2013).

Learning Management Systems (LMSs) and Virtual Learning Environments (VLEs)

The literature makes no definite distinction between a Learning Management System (LMS) and a Virtual Learning Environment (VLE). Technology platforms that support online teaching and learning use several (loosely equivalent) names such as: Learning Management Systems (LMSs), collaborative learning environments, course management systems and Virtual Learning Environments (VLEs).

The following definitions have been put forward:

- A Virtual Learning Environment (VLE) is a system that allows for learning materials to be made available to learners via the world-wide web. Typical services offered include collaboration and communication tools; student tracking and maintenance; and assessment (McGill & Hobbs, 2008).

- A Learning Management System (LMS) is a system which distributes interactive media, establishes channels of synchronous and asynchronous communication, manages the learning process and facilitates the participation of students and teachers in an integrated way (Alves, Miranda, Morais, & Alves, 2012).

Subsequently in this paper we adopt the terminology of an LMS to interchangeably denote a VLE as well. Hence, the myUnisa system may be viewed as an instantiation of an LMS/VLE. In this paper we evaluate three prominent LMSs, namely, Sakai on which myUnisa runs and the Moodle and Claroline platforms. We also evaluate the extent to which a previously developed framework of the authors (refer to the Appendix) satisfies the design principles of the LMSs presented in this paper. The framework in the appendix was developed following extensive literature reviews on ODeL and the requirements gathered of such a framework. The framework was developed in Kashora, van der Poll and van der Poll (in press).

The paper is organised as follows. The research questions underlying this work are given next, followed by the research methodology and analyses of three LMSs. The philosophies driving each of the Sakai, Moodle and Claroline platforms are discussed and these are compared with reference to their different attributes. We establish some desired properties of an LMS and argue to what extent the Knowledge Acquisition and Construction Framework in the Appendix satisfies such an ideal LMS. The paper concludes with a summary and directions for future work.
Research Questions

This paper aims to find answers to the following questions:

**RQ1:** What are the differences, advantages and disadvantages of three prominent and widely used LMSs?

**RQ2:** To what extent does our Knowledge Acquisition and Construction framework satisfy the requirements of an ideal LMS?

Research Methodology

This work forms part of a larger study which seeks to explore how Unisa students experience and evaluate online learning in Management Accounting. The research uses a descriptive phenomenological approach in order to answer the questions posed during the study. Research in essence, is a systematic investigation that seeks answers to a problem (Blaxter, Hughs & Tight, 2010). Penner and McClement (2008) recommend the use of a descriptive phenomenological approach when little is known about the topic under investigation. Online learning is a fairly new field; there is a need to understand the lived experiences of those learners in the field. Online web-based courses have advantages in that (i) learning can take place for as long as there is an Internet connection (learning any place, any time), and (ii) instructors can with reasonable ease upgrade and manage learning materials on the web.

Philosophies Driving Some Learning Management Systems

Numerous Learning Management Systems are used in higher education, government and the corporate world. Examples of these LMSs are Moodle, Sakai, Blackboard, Claroline, Ilias and Desire2Learn. In this paper the Moodle, Sakai and Claroline platforms are discussed and compared. These three platforms have much in common: Each has its roots in academia; each of these is based on an open-source portfolio; each has a modular architecture; each supports the popular standards of the SCORM (Sharable Content Object Reference Model) and each utilises efficient communication channels which encourage collaboration and interaction among students and instructors. One of the important outcomes emanating from these features is the efficient management of teaching, learning and research, both for on-site and distance learners.

In general, a Learning Management System should support the following: (Alves et al., 2012):

- A centralised and automated administration.
- Self-services (preferably self-guided).
- Rapid assembly and delivery of learning content.
- Scalable web-based consolidation of training initiatives.
- Portability and adherence to standards, such as Sharable Content Object Reference Model (SCORM).
- Personalisation of content and enabling of knowledge reuse.
- Distribution of teaching aids and managing course content: A VLE allows students access to important course components, e.g. syllabus, additional reading, workshops, tutorials etc. Students should also be able to download learning materials such as images, audios, videos and animations.
- Announcements: VLEs allow instructors to contact individuals, groups or the whole class enrolled for a specific course.
- Discussion forums: These allow participants, both students and instructors, to contribute discussions on the topic(s) raised.
• Submission of tasks: The e-learning platform facilitates instructor access to materials uploaded by the students, and vice versa; students can access their marked assignments and the solutions to assignments.
• Evaluating learning progress: VLEs provide for the development of online assignments, tests and exams, as well as setting dates and the time when students can take such assessments.
• Monitoring student activity per course: VLEs can maintain class lists, as well as other information like email addresses etc. Instructors can check the number of times that a particular student accesses a course or forum, and the duration of each access.

Next we give a brief introduction to the three (3) LMSs addressed in this work.

Moodle
Moodle started off in academia, and continues to be a major player in the higher education market. Moodle is more pedagogy oriented while Sakai is more oriented towards collaboration (see below). Moodle is an acronym for “Modular Object-Oriented Dynamic Learning Environment”. It is an open-source course management system that was designed using known pedagogical principles, and aimed at helping educators to create effective online learning communities (Bri et al., 2009). Moodle is programmed in PHP and it can, in principle, be installed on any computer that runs PHP. Moodle is a very popular free Course Management System (CMS). The choice of a LMS is of relevance for any e-learning project that is intended to deliver didactic modules for higher education.

Below are some characteristics of the Moodle platform (Bri et al, 2009):
• Promotes social constructivist pedagogy, consistent with the stipulation of the framework at level 1 (refer to the Appendix).
• Is suitable for online delivery and it can supplement face-to-face learning.
• It is easy to install on almost any platform that supports PHP. It requires just one shared database.
• It supports full database abstraction in the sense that it caters for all major brands of databases.
• Course listings give information of every course on the server, including accessibility to guests.
• Courses can be categorised and indexed – a single Moodle site can support very many courses.
• Security is maintained throughout.
• Most text may be edited via an embedded WYSIWYG HTML editor.

Generally, Moodle is ideal for lower resource organisations such as schools, small businesses, non-profit organisations, and local government agencies. One criticism sometimes levelled against Moodle is that it has many buttons and functionalities which allow for complex functions, yet complicating simple tasks (Lebrun, Docq & Smidts, 2009). Another criticism is that its implementation code is untidy because of very many open-source developers over its development period.

Sakai
Sakai is another free and open source platform that was built, and is maintained by the Sakai community. Sakai was developed by a consortium of five US Universities during 2004 and, presently, it is managed by the Sakai Foundation. It was first released to the public in 2005. Sakai is programmed in Java, it uses a modular architecture (Bri et al., 2009) and it aims to integrate train-
ing and communication capabilities (Alves et al., 2012). It is popular for its high-end features, scalability and security features which are discussed in a next section.

While Moodle is more pedagogy oriented, Sakai is more oriented towards collaboration among the facilitators and the learners.

The myUnisa e-learning environment is powered by Sakai, therefore the features and tools of the Sakai Framework determine the tools and features of myUnisa.

**Claroline**

Claroline was developed mainly from 2001 – 2002 and its aim was to promote pedagogic innovation at the Universite Catholique de Louvain (UCL) in Belgium (Lebrun et al., 2009). Claroline, like Moodle, was developed in PHP, and released under an open source GPL licence. It has a modular design and it complies with SCORM requirements. Compliance with SCORM enables programs to run on different LMSs, and to use the Sharable Content Objects (SCO) in different course structures. The source code is clear, thereby facilitating the development of new functionalities. It is more learning-oriented rather than being communication-oriented. Claroline was developed following teachers’ pedagogical experiences and needs (Lebrun et al., 2009). It allows course managers to set up efficient resources aimed at knowledge and skills acquisition, and uses technology as a support for pedagogy. The framework (refer to the Appendix) offers several opportunities to incorporate technology at the implementation stage (wikis, podcasts, video and Skype technology).

The methodology adopted by Lebrun et al. (2009) for Claroline is depicted in Figure 1. It shows information interacting with activities (abstraction, analysis, synthesis, evaluation, and critical thinking) as the learner constructs knowledge.

![Figure 1: An ICT-based pedagogical development model](Source: Lebrun et al., 2009).

Figure 1 is inspired and informed by a constructivist approach: information is, via students’ activities transformed into knowledge, which feeds into a next set of information gathering processes (Lebrun et al., 2009). The framework recommends constructivism as the theory of choice when it comes to technological applications and implementations; an often cited outcome of this approach is the deep understanding of the concepts at play.

Bri et al. (2009) confirm that the effect of ICT in producing more active learning methods is substantial. To this end a LMS like Claroline facilitates the use of experimental methods by a lecturer in pedagogical innovations.

The Claroline platform is based on the teacher’s needs which include (Consortium Claroline, 2006):
• Publishing documents and announcements,
• Giving students tools to develop activities and to demonstrate their skills,
• Allowing interactions among students and with teachers.

Next we compare the above LMSs, using mainly the criteria in Fakhreldeen (2013).

**Comparing the 3 LMSs – Moodle, Sakai and Claroline**

First we perform comparisons with respect to system requirements and architecture.

### System Requirements and Architectures

Table 1 shows the underlying system architectures associated with each.

<table>
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<th>SAKAI</th>
<th>CLAROLINE</th>
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</tr>
<tr>
<td>3</td>
<td>Programming language</td>
<td>PHP</td>
<td>JAVA</td>
<td>PHP</td>
</tr>
<tr>
<td>4</td>
<td>Web server</td>
<td>ANY</td>
<td>APACHE</td>
<td>APACHE</td>
</tr>
<tr>
<td>5</td>
<td>Application server</td>
<td>PHP4</td>
<td>TOMCAT</td>
<td>APACHE</td>
</tr>
</tbody>
</table>

*Source: Adapted from Fakhreldeen (2013)*

From Table 1 we infer:

Programming language comparisons are complicated to some extent since Sakai is written in Java; the other two are written in PHP. Consequently, different system requirements (e.g., operating system or web/application server) may result.

Apart from the Application Server, the Moodle LMS appears to be the most versatile of the platforms since it supports the largest variety of system requirements.

### Philosophies

Table 2 presents some of the common philosophies for Moodle, Sakai and Claroline.

The following may be inferred from the literature and Table 2:

• Suri and Schumacher (2008) confirmed in a survey on Sakai, Moodle and Blackboard that Sakai is simpler to use but lacks some of the richer functionality available in Moodle and Blackboard (not part of our study). However, some users argue that, naturally, with improved functionality, Sakai could become highly competitive. There is, therefore, a need to improve on the Sakai platform in order to have the capacity to respond to new educational requirements.
Table 2: Philosophies driving the learning management systems

<table>
<thead>
<tr>
<th>NO</th>
<th>FEATURE</th>
<th>MOODLE</th>
<th>SAKAI</th>
<th>CLAROLINE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Open-Source Portfolio</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>2</td>
<td>Modular Architecture</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>3</td>
<td>SCORM Compliant</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>4</td>
<td>Communication Channels</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>5</td>
<td>Collaboration &amp; Interaction</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>6</td>
<td>Manage Teaching, Learning &amp; Research</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>7</td>
<td>On-Site and Distance Support</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>8</td>
<td>Constructivist Theory</td>
<td>Y</td>
<td>Collaboration</td>
<td>Y</td>
</tr>
<tr>
<td>10</td>
<td>Client-Server Architecture &amp; Cloud</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
</tbody>
</table>

Source: Adapted from Fakhreldeen (2013)

Further Metrics of Comparison

Table 3 shows additional metrics to be used in a comparison of the three LMSs.

Table 3: Metrics for comparing the learning management systems

<table>
<thead>
<tr>
<th>NO</th>
<th>METRIC</th>
<th>MOODLE</th>
<th>SAKAI</th>
<th>CLAROLINE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Support</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>2</td>
<td>Security</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>3</td>
<td>Ease of use</td>
<td>Y</td>
<td>Y+</td>
<td>Y+</td>
</tr>
<tr>
<td>4</td>
<td>Management</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>5</td>
<td>Interoperability</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>6</td>
<td>Flexibility</td>
<td>Y</td>
<td>Y</td>
<td>Y+</td>
</tr>
<tr>
<td>7</td>
<td>Performance</td>
<td>Y+</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>8</td>
<td>Communication tools</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
</tbody>
</table>

Source: Adapted from Fakhreldeen (2013)

In Table 3, “Y” represents an acceptable level (a qualitative measurement) of the metric while “Y+” represents an even higher score on the same scale.

The following are inferred:

- Sakai and Claroline score higher than Moodle in the category “Ease of use”.
- Claroline measures best on “Flexibility”.
- The “Performance” score of Moodle is the best of the three LMSs.
Verdict
The three platforms Moodle, Sakai and Claroline each have many good features on offer; some score better than the others. The features are given in tables 1 – 3 and the syntheses following each.

Ideally, an LMS should be developed that includes the best features of the three platforms combined – Moodle is preferred when it comes to system requirements and architectures; Sakai appears to be best with respect to the underlying philosophies (Table 2), while Claroline appears to be preferred when it comes to the metrics in Table 3. Therefore, each platform has something unique to offer, hence we call for the development of a (new) LMS that incorporates the best features (and scores) of the three LMSs.

The above discussion answers our 1st research question (RQ1).

Before we investigate the extent to which our Knowledge Acquisition and Construction Framework in the Appendix satisfies the design principles of the above three LMSs, we present some further insights into Sakai, the platform on which the myUnisa system of a large ODeL institution (Unisa) has been implemented.

Sakai Learning Platform
Sakai is considered to be the best of the three LMS above with respect to its reporting features. This holds also for the relative ease in which it may be customised and rebranded (Table 3), and for its collaboration characteristics (Table 2).

Bri et al. (2009), however, report that Sakai falls short on profiling and management. They also report it to be challenging in integrating Sakai with other enterprise software systems. Another disadvantage usually associated with most open-source Learning Management Systems is that each can cost as much or even more than a commercial product. In particular, the costs for technology procurement and maintaining the infrastructure; training staff; and ongoing support may be as high as for a commercial product. Despite these drawbacks, the Sakai e-learning Platform continues to penetrate the higher education market at an increasing speed.

Despite the above disadvantages, the Sakai e-learning Platform has, therefore, distinguished itself from the competition by displaying some attractive characteristics. In this regard, the following are reported by various sources, notably, the International Institute of Informatics and Systemics (http://www.iiis.org/) and Bri et al. (2009):

- General student and lecturer collaboration features, e.g., wikis; course management and announcements; RSS feeds, etc.
- Typical teaching and learning characteristics which allow for lecturers to plan and construct lessons, create and assess assignments and share documents via cloud drop boxes. Naturally, the use of cloud technology (e.g., drop boxes) is essential in ODeL.
- Administrative management and Portfolio tools.
- Sakai has an initial list of options from where it is possible to access different learning resources (learning materials, discussion forums, notices, tasks, assessment tests, etc.).
- The Sakai 2.5 e-learning platform assigns each group a private folder that enables members to upload and download homework, assignments and specific documentation – another requirement of ODeL.
- The Sakai LMS allows lecturers to upload multiple documents simultaneously.
- The Sakai platform has a ‘Student’s Portfolio’ which can be customised by each student and be used to present course work and projects.
• Sakai 2.5 LMS provides each user with a particular directory to share information with other students enrolled for the course.

Next we evaluate the extent to which our framework for Knowledge Acquisition and Construction in the Appendix satisfies the design aspects of the LMSs addressed in this paper. Such framework was first developed in Kashora, van der Poll and van der Poll (in press), and its utility in terms of technical subject activities was illustrated in Kashora, van der Poll and van der Poll (2013).

**Evaluating the Utility of the Framework for a LMS**

Our framework contributes to the design principles of the LMSs through:

1. **Skyping**: The framework encourages the use of Skype.
2. **Teaching and learning (T&L)**: The Knowledge Acquisition and Construction Framework addresses a number of requirements as reported on by Alves et al. (2012). These include the use of synchronous (videoconferences, real-time chats, whiteboards etc.) as well as asynchronous (e-mails, blogs, wikis, podcasts, discussion forums, etc.) communication tools. The majority of these are also part of (e.g.) the myUnisa system on Sakai. Every student has a myUnisa email profile (myLife) and can communicate with administration and other registered students.
3. **Constructivism**: The Knowledge Acquisition and Construction Framework may assist students with their learning programs. For example, the constructivist theories may be employed to encourage students to construct their own ideas, meaning and understanding. The above T&L interactions (point 2) are premised on the theories of constructivism.
4. **Acquiring ICT skills**: Lecturers are to be assisted by improving on their ICT skills through pedagogical innovations. The myUnisa platform has an abundance of technology-rich functionalities. The lecturers need to be prepared to implement new methods that use ICTs. Such innovative ways would empower the lecturer as well as his/her methodologies in terms of technology. The framework acknowledges these requirements.
5. **Scaffolding**: The myUnisa platform has an Additional Resources section which often contains additional material to elaborate on subject concepts. This is an example of a learning scaffold as suggested in the framework.
6. **Endless repetition**: The framework encourages “practising endless repetition”. The assignments and past examination questions on the myUnisa platform can fulfil this function for distance learners (users).

The above answers our 2nd research question (RQ2).

**Conclusions and Future Work**

This paper evaluated three (3) Learning Management Systems, also known as Virtual Learning Environments. The Moodle, Sakai and Claroline platforms were evaluated with reference to their system requirements and architectures; underlying philosophies; and a number of additional metrics like ease-of-use, flexibility, performance, etc. It was found that each of the three platforms outperforms the other two in at least one of the features mentioned. Subsequently we suggested the design of a LMS that incorporates the best features of the three platforms.

Our framework for facilitating Knowledge Acquisition and Construction was evaluated with respect to the properties of the LMSs investigated in this work. It was found that the framework indeed incorporates many of the properties of a good LMS. The use of the Knowledge Acquisi-
Knowledge Acquisition and Construction Framework for Learning Management Systems

tion and Construction Framework could facilitate organising a complex subject like e-learning, which is evolving and changing as a result of adopting new technologies and new forms of learning.

To the knowledge of the authors, little research has been done on how students experience and evaluate online learning. Hence, future work in this area will be to enhance the framework in the Appendix. This will be through qualitative surveys among the lecturers and students of some undergraduate Accounting courses at Unisa (University of South Africa), a large role player in the ODeL arena.

References


### Biographies

**Trust Kashora** obtained his MCom from the University of South Africa in 2006. He is currently a DCom student at the University of South Africa in the Department of Management Accounting with promoters Prof. HM van der Poll and Prof JA van der Poll. His research interests are in the use of ODeL in knowledge acquisition and construction in Management Accounting.

![Trust Kashora](image)

**Huibrecht Margaretha van der Poll** obtained her MCom degree in 2004 and her DCom in 2007 from the University of Pretoria. She is currently a Professor in Management Accounting at the Graduate School of Business Leadership at the University of South Africa where she supervises a number of MBL and DBL students. Her current research interest is in the field of facilitating a greener environment through Management Accounting. She has published widely and has delivered many papers at different National and International Conferences.

![Huibrecht Margaretha van der Poll](image)

**John Andrew van der Poll** holds a PhD in Computer Science. He is a Professor in ICT Management at the Graduate School of Business Leadership at the University of South Africa where he teaches courses in Business ICTs. His research interests are in Formal Specification Techniques; Automated Reasoning; Combining formal and semi-formal specification notations and the management thereof. He supervises numerous Masters and Doctoral students and has published widely in these areas. He leads a project aimed at determining the impact of Formal Methods in industry.
Appendix A

Figure 2: Knowledge Acquisition and Construction Framework
Identifying the e-Skills Needed for the Effective Utilisation of Electronic Small Businesses Development Support Services

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Abstract
As a country South Africa faces numerous socio-economic challenges, for instance high levels of poverty and unemployment particularly among people in previously disadvantaged areas (PDAs). In order to overcome these and other challenges the South African government identified small businesses as possible solutions. These businesses are considered to be ‘engines of economic growth’ and job creators. For this reason government and the civil society (Non Profit Organisations) started utilising the Information and Communication Technology (ICT) to provide various types of wider reaching electronic support (e-support) to them. However, in spite of the availability of this e-support, small businesses nationally, especially in previously disadvantaged areas (PDAs), where they are needed most, are frequently failing. A number of studies into this failure suggest that inter alia the business owners, managers and employees are not using the provided e-support. This was found to be largely due to the insufficient ICT-related skills (e-skills). It was, thus, necessary to further investigate the influence of e-skills or lack thereof on the use of the support. The findings of this study support the premise that different levels of e-skills among the business owners and managers either promote or discourage the use of any sort of e-support. The study also highlighted other factors such as a lack of information and ICT access, which negatively influence the use of e-support. It is envisaged that the recommendations of this study will help small business, civil society organisations and government agencies to understand which e-skill are necessary if e-support that is coming from government or NPOs is to be effectively utilised.

Keywords: Government agencies, NPOs, Service Providers, Electronic Support (e-Support), Small Businesses, Electronic Skills (e-Skills), Information and Communication Technology (ICT), Previously disadvantaged Areas (PDAs)

Introduction
“For every [South African] small business that closes …6-8 jobs are lost”.
(Business Times, 13 January 2008)

The above statement appropriately illustrated the importance of the small business sector for South African (SA) economic development – particularly local economic development. The highest
significance of small businesses prompted the SA government to initiate organised effort to support small businesses. These efforts arguably began after the 1994 independence when the new SA government introduced a white paper on national strategy for the development and promotion of small business in South Africa - Notice 213 of 1995. This national document acknowledged the importance of this sector and the commitment of government to the establishment of a number of supportive mechanisms.

The success of small businesses, especially those in the previously disadvantaged areas (PDAs), is considered essential since they are key contributors to the economy. These businesses are strategic tools that help government address social challenges the country faces. These challenges are predominantly more common in the countries PDA communities (Presidential National Commission on ISAD, 2013), with examples including unemployment, crime and poverty. High levels of poverty, in particular have been a problem for government since 1994 (Mensah & Benedict, 2010), affecting mostly people in PDAs of the country.

There is a strong need for more effective support for small businesses. These businesses have been found to have low success rates as a result of a number of factors, some of which are irredeemable (Mitrovic & Bytheway, 2009). The review of pertinent literature has shown a variety of potential sources of support for small business development: (i) Seeking support from other businesses (usually at cost), (ii) working with community-based NPOs (at very low or no costs) and (iii) help from government (Mitrovic & Bytheway, 2011). Much of this support is provided through information and communication technologies (ICT), notably through Internet which is referred to as “electronic support” (e-support).

The e-support is provided in order to encourage entrepreneurship and help struggling small businesses. It was found that an average of 60% to 80% of these businesses fail within the first 2 years of trading (Jacobs, 2010). The choice to make use of any type of ICT for business purposes in heavily influenced by the small business owners characteristics, technical expertise, willingness and attitude towards ICT (Harindranath, Dyerson & Barnes, 2008). As such, the study focused more on the e-skills levels of the business owners and less so on the employees because the owners are responsible for making the top level decisions about the use of ICT for business purposes. Additionally informal small businesses in PDA are survivalists, also known as sole proprietors, meaning they are run by one person – the small business owner.

Coupled with small businesses, ICT was identified as a key facilitator in overcoming social challenges that the country faces. Government or Non Profit Organisations (NPO) services, which were once offered offline, are now provided electronically and can be accessed anytime from anywhere (Demunter, 2006; Mitrovic & Klaas, 2012). Given the ease with which the Internet facilitates informational service delivery, governments have embraced it as a major tool for improving the economy and standards of living for all citizens. Government at all levels (local, regional and national) are using ICT to provide better e-support for small business development. The e-support includes Internet based information services and easy, as well as cost effective access to ICT resources such as computers with Internet access, printers and photocopiers and, increasingly, mobile technologies. Small businesses that cannot afford to own these resources can use the provided e-support resources for the development of their businesses.

Although NPOs can be useful in providing support to the community-based small businesses, it was found that these organisations mainly offer the same kind of services as the government agencies (Mitrovic & Bytheway, 2009). Therefore, this study concentrated on the e-support services provided by various government agencies in South Africa.
Problem Statement and Objectives

Despite the magnitude of e-support provided to small businesses in PDAs, these businesses are continuing to have high failure rates. Furthermore, the business owners are not utilising the available e-support effectively. A number of studies suggest that the reason for this lies in the lack of ICT (electronic) skills, frequently referred to as “e-skills”, among the small business owners or employees (e.g., Ashrafi & Murtaza, 2008; McGrath, 2005; SEDA, 2009; Underwood & Jacobs, 2007; Wesso, 2010). Consequently, in order for any available e-support to be utilised fully, the intended beneficiaries (small businesses, in this case) need to possess the e-skills necessary for using these ICT-based services (McCormack, 2010).

As such, the objective of this study was to identify the e-skills needed for the effective utilisation of e-support by small businesses owners (and their employees) in PDAs of South Africa. In order to achieve this objective, the study set out to achieve the following:

- To obtain an overview of the business owners knowledge of e-support.
- To investigate and document the e-support available to small businesses in PDAs of Cape Town in particular.
- To explore the different local and international constructs of e-skills, so as to identify the specific e-skills that small business owners and employees need in order to utilise e-support effectively.
- To provide recommendations to government, their agencies and small businesses for the improved utilisation of e-support. Thus promoting local economic development through successful small businesses.

Approach to the Study and Basic Concepts

Anticipating which e-skills are needed, and when they will be needed, is not an easy task (Republic of South Africa: DHET, 2010). Careful planning and clear understanding of the context where the e-skills are needed is necessary to facilitate the process. As such, the first stage of this exploratory Case Study involved setting a clear scope for the investigation. The study was restricted to small business owners in PDAs (particularly Gugulethu, Khayelitsha and Langa) of Cape Town. These areas were selected because they constitute the largest PDAs in the Western Cape area, the empirical setting of this research. Focus was placed on government agencies that provide e-support intended to benefit small businesses in the particular areas of interest. These agencies provided e-support for free or at a very low cost. Moreover since most business owners principally informal business owners are living below the poverty line, this type of e-support is badly needed.

The selected government agencies included:

- National level: Small Enterprise Development Agency (SEDA),
- Provincial level: The Real Enterprise Development (RED) Door, and The Cape Gateway,
- Local level: The Smart Cape Project.

The next stage involved adopting working definitions of the key concepts of the study. This was done because concepts such as e-support and e-skills do not have commonly adopted definitions (Beyers & Koorbanally, 2010). Thus, for this study, the term e-support referred to support provided by government agencies through the Internet. This type of e-support related mainly to the provision of information regarding, for instance, various types of training, business registration, access to finance, lawyers and accountants among many other things. This e-support also includ-
Identifying the e-Skills Needed

ed free or low cost access to ICT based resources (computers, printers and other relevant technologies). The concept of e-skills related to the knowledge, skills and competences associated with the use of ICT (European e-skills forum, 2004). The proven ability to then apply skills, knowledge and attitudes to achieve observable results (e-CF, 2011) was referred to as e-competence.

After adopting working definitions of the key terms, the e-support provided by the selected agencies was documented and then categorised. This process involved taking information about the available e-support services directly off the service provider’s websites. Additionally, the accuracy of the services was then confirmed by a representative from each of the agencies. These representatives were also able to provide additional information regarding available e-support services that were not listed on their websites. The complete list of documented e-support services contained over 55 different services offered to small businesses. Examples included access to information on how to create and manage an email account, links to financial resources, available lawyers and accountants, among many others. All the e-support services were then grouped into the following 5 categories: (i) Training services; (ii) potential and existing business support; (iii) online information resources; (iv) ICT infrastructural support; and (v) promotional small business development incentives.

The study included a review of pertinent literature that analysed different e-skills frameworks, models and taxonomies (local and international). The intention was to identify the specific e-skills (attitudes, knowledge and skills) that are needed to use a particular type of e-support provided. The most noteworthy documents were: The National e-Skills Plan of Action (NeSPA), The Skills Framework for the Information Age (SFIA), the e-Competence Framework (e-CF), the South African e-skills council model and Romani’s (2009) e-competency model. After a comprehensive analysis of the various tools the most appropriate one that highlighted the most fitting e-skills was selected.

It was found that the e-competence model designed by Romani (2009) detailed the most appropriate set of e-skills, given the scope of the study. Romani identified 5 key competence areas, which were referred to as literacies: (i) e-Awareness; (ii) informational literacy; (iii) technological literacy; (iv) digital literacy; and (v) media literacy. Additionally, the e-competence model could be applied in scenarios where small business owners or employees had either no e-skills, very basic e-skills or advanced e-skills. The model supported a gradual growth process.

Each of the competences (literacy) is accompanied by a detailed explanation of the attributes that make up that competence. Thus, the e-skills (skills, attitudes and knowledge) needed to use specific e-support services were identifiable. It must be noted that although, Romani uses the term literacy to contextualise the e-competence areas, for the sake of this study these literacies are referred to as e-skills. This was primarily because e-competences are, by definition, made up of skills, attitudes and knowledge, which are all general subsets of e-skills (e-CF, 2011).

In order to obtain more detailed definitions of the e-skills identified by Romani (2009), the authors examined other available definitions. Based on the findings grounded in literature the model was adjusted and definitions enhanced. An additional e-skill “Basic literacy” was added. This was done in order to elaborate the detail and scope of the original model, thus tailoring it more to the needs of the small businesses. Moreover, the skills, knowledge and attitudes associated with basic literacy formed the foundation for the other five e-skills.

The final set of e-skills that were proposed included combined definitions from various authors namely, American Library Association, 2011, Bruce (2003), Catts (2010), Catts and Lau (2008), EAVI (2011), IBSA (2010), Livingstone (2004), McCormack (2010), Maharana and Mishra (2007), Romani (2009), Rosado and Be’lisle (2006), Tilvawala, Myers and Andrade (2009), as
well as UNESCO (Horton, 2008). The final list of proposed e-skills and their definitions included:

(i) Basic literacy (foundation skills)

These skills were also referred to as foundation skills. They included the ability to read, write, count and communicate orally. Moreover, basic literacy related to the small business owners and employees thinking and problem solving skills. Their ability to determine, recognise, define and articulate the information needs of the business, also fell under basic literacy.

(ii) e-Awareness

e-Awareness was directly related to being knowledgeable and possessing accurate information about ICT. This included knowledge of where to access a computer and/or the Internet. This awareness also involved knowing the contribution and benefits that can be achieved from using ICT. Additionally, e-awareness related to their knowledge of government agencies that provided e-support and details regarding the e-support services they provided to small businesses.

(iii) Technological literacy

These e-skills were mainly concerned with the confidence and practical ability to use ICT. Focus was placed on skills levels, technology use, and the motivation behind the use of computers and the Internet. Attention was also placed on where the business owners and/or employees got access to ICT and the effects of limited access as well as e-skills on the use of the provided e-support.

(iv) Informational literacy

The attributes of informational literacy related to information, being able to find it either online, through search-engines, or offline. The associated e-skills included the ability to read with meaning, understand, and interpret information from various kinds of sources. Informational literate small business owners in particular, would need to possess other skills and competences associated with managing information, in order to gain knowledge.

(v) Digital literacy

Digital literacy related to the attitudes, skills and knowledge required to use ICT at a more advanced level. At this stage, the small business owners would be able to make use of ICT, primarily computers, and the Internet to facilitate business transactions. Examples of these transactions include online banking, submitting applications for tenders and electronically communicating with customers, suppliers and other businesses.

(vi) Media literacy

The associated e-skills related to the understanding of the legal implications of using or sharing information found online. Media literacy was also concerned with the understanding of the various media platforms that were sources of information (i.e. radio, television, newspapers, pamphlets and the Internet). The business owners, as well as the employees, needed to know how to access the platforms and use them as tools.

The stage that followed the identification of the proposed e-skills was the correlation of the e-skills and e-support. This process included identifying exactly which e-skill was needed to use a particular e-support service. For instance, basic literacy and e-awareness skills were relevant in order to utilise any and all of the available e-support services. In order to get any sort of information the business owners needed to know it existed, where and how to find it, including being able to read and understand the content. Consequently each of the identified e-support services was then aligned with the e-skills associated with the use of that particular service. Based on the information collected during the correlation process, the next stage was to test the literature review findings (accurate relevance of the proposed e-skills) in the empirical setting of the study.
The sample for this Case Study constituted 16 purposively selected small businesses and 9 representatives from e-support providing agencies. Due to the nature of this study, the data were collected from the above mentioned participants in their natural setting, using face-to-face interviews. The data were then analysed using the qualitative content analysis technique, facilitated partially by the qualitative data analysis software tool, Nvivo 10.

**Findings and Discussion**

The findings of the study were twofold. Firstly, the relevance of the proposed e-skills among the small business owners and employees was confirmed. Secondly, challenges other than the lack of e-skills, that were faced by the business owners’ in relation to their use of e-support were also identified. Each of the e-skills and associated findings are discussed separately. The findings are in some cases grouped according to whether the small business was formal or informal. Table 1 summarised the main attributes of the sample population.

*Table 1: Summary of the sample population biographical data (source: Authors)*

<table>
<thead>
<tr>
<th>SMALL BUSINESSES</th>
<th>SERVICE PROVIDERS</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Business Type</strong></td>
<td><strong>Agency Type</strong></td>
</tr>
<tr>
<td><strong>Small business category</strong></td>
<td><strong>Agency Name</strong></td>
</tr>
<tr>
<td><strong>Number of years business has been operating</strong></td>
<td><strong>Interviewee Position in Agency</strong></td>
</tr>
<tr>
<td><strong>Formal or Informal</strong></td>
<td><strong>Location</strong></td>
</tr>
<tr>
<td><strong>Location</strong></td>
<td><strong>Location</strong></td>
</tr>
<tr>
<td>1. Funeral Parlour Owner</td>
<td>1. Public library e-centre</td>
</tr>
<tr>
<td>Survivalist</td>
<td>Smart Cape</td>
</tr>
<tr>
<td>4 Years</td>
<td>Senior Librarian</td>
</tr>
<tr>
<td>Informal</td>
<td>Khayelitsha</td>
</tr>
<tr>
<td>2. Seamstress</td>
<td>2. e-Innovation PGWC</td>
</tr>
<tr>
<td>Micro</td>
<td>Smart Cape, Cape Access</td>
</tr>
<tr>
<td>6 Years</td>
<td>e-Gov Specialist</td>
</tr>
<tr>
<td>Informal</td>
<td>Cape Town CBD (Head Office)</td>
</tr>
<tr>
<td>3. Edu Care Centre</td>
<td></td>
</tr>
<tr>
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<td>6. Furniture Shop</td>
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<td>Gugulethu</td>
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<td>7. Fast Food Kitchen</td>
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<td>Micro</td>
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<td>8. Hair Salon</td>
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<td>9. Hair Salon</td>
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<td>10. Hardware Shop</td>
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<td>Micro</td>
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<td>Gugulethu</td>
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<td>11. Law Firm</td>
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<td>Very Small</td>
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<td>6 Years</td>
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<td>Formal</td>
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<td>Khayelitsha</td>
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<td>12. Mini Market</td>
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<td>Micro</td>
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<td>13. Mini Market</td>
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<td>Khayelitsha</td>
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<td>14. Butchery and Restaurant</td>
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<td>Very Small</td>
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<td>2 Years</td>
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<td>Gugulethu</td>
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<td>15. Computer Repairs Shop</td>
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<td>Micro</td>
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<td>16. Hair Salon</td>
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Main Findings Regarding the Relevance and Influence of the Proposed E-Skills

(i) Basic literacy (foundation skills)

The findings supported the fact that the employees and owners of small businesses in PDAs needed to have basic literacy skills in order to use e-support. Out of 10 informal business owners only 1 was educated further than grade 10. These business owners were not very fluent in the command of the English language, their reading and writing skills were also limited. Thus although they were in dire need of any type of support, they could not access e-support in particular due to their limitations. Consequently the business owners that did not have basic e-skills avoided using ICT in general. In addition, they had negative attitudes towards computers and the Internet because they could not use them.

On the other hand 5 of the 6 formal business owners had tertiary qualifications, thus they possessed basic literacy skills, and they could read and understand the content on service providers’ websites. Moreover, they had thinking and problem-solving skills, which allowed them to determine and recognise the information needs of their businesses. These business owners proved that having basic literacy skills put them in a better position to access and use e-support.

(ii) e-Awareness

In order for the e-support to have been accessed and utilised at any level the intended beneficiaries (owners and employees of small businesses) needed to know it existed. Furthermore, they needed to know about the existence of computers and the Internet as well, considering that e-support is provided mostly through these and other such technologies. It was found that out of the total 16 (formal and informal) small business owners 12 knew where to access a computer. Out of this group of 12 business owners, 4 had never used a computer before. These 4 were also truly uninformed about how to use a computer and/or the Internet, they only knew of them.

It was found that small business owners in particular, that were aware of the existence of computers and the Internet, including where and how to access them, were in a more advantageous position. These business owners were benefitting economically, socially and personally from the use of the provided e-support. In addition, they were more knowledgeable about how e-support could be used to find business support information and perform business-related tasks. However, some might not have had the technical e-skills needed to use the computers and Internet to perform these tasks themselves. In these cases they asked the ICT centre assistants or the person sitting next to them for help, or to access the computers on their behalf.
Identifying the e-Skills Needed

9 small business owners were not aware of any e-support services available, including how and where to access them. However, of the 7 business owners that were aware of the existence of government agencies that provide e-support, 2 had an official relationship with an agency, which provided them with information on available tenders and e-skills training.

(iii) Technological literacy

The findings regarding technological literacy revealed 3 main groups of e-skills levels among the business owners. The smallest group of business owners had advanced e-skills, followed by the group with basic e-skills and lastly, the largest group which had no e-skills at all. 8 business owners admitted they had no e-skills at all, they also acknowledged that they needed computer related training. This lack of e-skills was due to the lack of funds, limited education and exposure to ICT. These business owners also revealed that they often felt pressure from external forces such as, customers, suppliers and other businesses to use computers. It was also observed that business owners who lacked e-skills were demoralised and felt digitally excluded. This was primarily because they could not physically use computers and/or the Internet, even though they had a strong desire to do so.

Due to their limited education levels and exposure to technologies such as computers, it was found that informal small business owners made up the majority of business owners with either no e-skills or very basic e-skills. These business owners were also more comfortable using their cell-phones to access the Internet. They were too shy to go to public libraries to access the Internet because of their limited e-skills. They did not want their lack of e-skills to embarrass them. Furthermore, the informal small businesses were in most cases survivalist entrepreneurs as a result they could only afford to leave the business to go access a computer and/or Internet once or twice a month, which did not give them enough time to build any e-skills or benefit from utilising e-support services.

The reasons why small business owners whether formal or informal, accessed the Internet varied. The service providers revealed that firstly, small business owners mostly looked for business tenders and business support information. Secondly, they even looked for job vacancies and thirdly they often checked their marital status. This was as a result of the high identity theft rates in the communities. Another main reason for using the Internet was social networking, particularly Facebook and Skype, which were found to be the most popular.

Only 2 formal small business owners had advanced levels of e-skills. As a result they had the confidence and ability to use computers and the Internet. Furthermore, they could use these technologies to access and utilise e-support. They could also exploit various other technologies to perform business related tasks. These particular business owners used electronic resources such as word processing, spreadsheets, databases and other tools to process, design, store and manage their business related information.

(iv) Informational literacy

The responses given by the small business owners and service providers highlighted that the choice of which source of information to use was based on trust, convenience, cost and reliability. Thus although the Internet was the most trusted source, it was regarded as not being cost effective to access or reliable – government websites were said to usually have outdated information. Consequently since the business owners could not always access the Internet (which they preferred) for information they resorted to the print media especially newspapers as a means of receiving information. The preferred sources of information among the small business owners if access and cost were not factors are highlighted in Figure 1.
The study also found that owners of small businesses, including their employees needed to have informational literacy skills. The business owners in particular that had these skills (coupled with previously mentioned e-skills) were independently able to use computers (and other capable devices such as cell-phones). They could use these technologies to look for and find information online or offline. Moreover, they were able to read, understand, judge, compare and interpret any business support information that was found electronically or from other different sources. It was also observed that owners of small businesses with these skills could generate and protect their own information. They could also use both manual and electronic mediums (e-mail, instant messaging and digital forums) to communicate and share the information.

(v) Digital literacy

It was observed that informal business owners were more sceptical and thus slower at taking up technology. In contrast, formal business owners were more dependent on technology to carry out day to day transactions. Only 5 of the total number of (formal and informal) business owners made use of the Internet either daily or on occasion for business purposes. Out of this group 2 formal business owners stated that without access to the Internet their businesses would collapse. Furthermore, out of the fear of becoming digitally excluded 12 of the total number of business owners indicated a strong desire to either adopt technology into their businesses or upgrade. The technologies they wished to adopt or upgrade included, computers, laminating machines, photocopiers, printers, fax machines, ADSL modems, and computerised points of sale. They also wanted bigger computer servers, bar-code scanners, Closed-Circuit Television (CCTV), generators and control mechanisms for refrigerators. Figure 2 highlights findings regarding technology adoption among the formal and informal businesses. These findings relate to the owning of computers, use of the Internet for business purposes and having a business website.

Figure 1: Small business owners in PDAs preferred sources of information (source: Authors)
Identifying the e-Skills Needed

It was also noted that the owners of small businesses that had digital literacy skills were not only able to build new knowledge, but also strategically use ICT to facilitate business intelligence. They were capable of using ICT to simplify business transactions, such as organising information, online banking and communication (on multiple formats, either textual or multimedia). Thus, these skills enabled the small business owners to embrace the use of technology socially and for the benefit of their businesses.

(vi) Media Literacy

It was found, in addition to the skills mentioned above, that owners of small businesses also needed media literacy skills. The small business owners who were furnished with these skills understood how to access and use different media platforms (for instance, television, radio, print media and the Internet) to share, advertise, communicate and retrieve information. They also understood the legal implications of using different media platform to share or retrieve information.

The business owners that were not media literate were unfamiliar with any media platforms available to retrieve or share information, other than newspapers, TV and radio. These particular business owners still however lacked helpful information on how to go about it. 10 business owners might have been aware of the different media platforms but they were largely uninformed about any legal implications of sharing or using copyright material found electronically. Moreover, 6 business owners had never advertised their businesses. These business owners relied only on word of mouth because they were not media literate.

Barriers towards the Utilisation of E-Support

Further analysis of the data showed a number of challenges in addition to the lack of e-skills that are faced by small businesses, in regards to the use ICT to utilise e-support. Unless these challenges are addressed the utilisation of e-support by small businesses will still be minimal, even if the owners or employees possess the required e-skills.
(i) Unstable supply of electricity

The business owners stated that it was not possible to rely on technology, because at any time the electricity could be turned off. As a result they would not be able to access their information when they needed to. Consequently, the majority (13) small business owners preferred to keep and receive only printed copies of information.

(ii) High crime rates in PDAs

Due to high levels of crime some small business owners were hesitant to buy computers that they could use to access e-support. It would be too costly as they would also have to invest in security measures to protect their computers. While in other cases the business owners strongly believed that advertising their business would attract thieves to their premises, thus they preferred not to.

(iii) Pride, shyness, lack of patience and low self confidence

Agents that provided e-support declared that some small business owners, evident more with the older generation had too much pride to admit that they need assistance. This was found true especially in cases where the assistants were much younger in age. In other cases, business owners were shy, because they were not confident in their abilities, resulting in low levels of self-confidence and them avoiding using computers or other technologies altogether.

(iv) Perceived ease of use

The first form of interaction with a particular website plays a role in the manner in which a person feels about themselves and their abilities. First time users or users that are not so confident in their abilities, tend to get easily intimidated by complicated websites and processes.

(v) Lack of adequate resources to cater for demand

Even with the numerous initiatives put in place to provide e-support in terms of free access to computers and the Internet, there is still a great demand. Each of the libraries and community centres in the areas of interest had a range of 6 to 12 machines. In most cases, this was still not enough to cater for the demand, resulting in very slow up-take of computers. Additionally the computers were old and very slow, which also frustrated the users.

**Recommendations for Government (Providers of E-Support) and Small Business Owners (Intended Beneficiaries of E-Support)**

The main objective of the study was to identify the prerequisite e-skills needed to fully utilise e-support because without e-skills neither the small business owners nor their employees can utilise any available e-support services. There are four primary stakeholder categories involved in providing e-skills: (i) Business; (ii) government; (iii) education; and (iv) civil society/labour (Republic of South Africa. DoC, 2010).

Although there is heavy debate regarding the levels of responsibility, for each body (category), government is tasked with the heavier burden (Republic of South Africa DoC, 2010). Considering that the e-support is provided for the benefit of small businesses, the owners and employees are also significantly responsible for taking the initiative of e-skilling themselves. Table 2 highlights some recommendations for government and small business owners. These recommendations relate to how best to equip South Africans in general, small business owners in particular and their employees with the e-skills, information and ICT based resources needed to improve the use of e-support. The recommendations are based on findings grounded in literature (e.g, NeSPA), results
of the study, suggestions from the intended e-support beneficiaries (small business owners, as well as employees) and service providers.

**Table 2: Government and small business owners’ roles in providing and gaining e-skills**
(source: Authors)

<table>
<thead>
<tr>
<th>Stakeholder</th>
<th>Strategy/ Responsibilities</th>
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<tbody>
<tr>
<td>Government</td>
<td>• Strengthen partnerships between business, local government, communities and civil society.</td>
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<td></td>
<td>• Making use of cell-phone technology to communicate with business owners.</td>
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<td></td>
<td>• Forming partnerships with private sector/ NGO’s in order to bring technology and e-skills to all citizens, including business owners and employees.</td>
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<td></td>
<td>• Implementing free Internet connectivity initiatives that cover large areas (For example the free Wi-Fi initiative in the town of Stellenbosch).</td>
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<td>• Increase access to educational funding.</td>
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<td>• Increase ICT literate teachers and trainers.</td>
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<td></td>
<td>• Ensure that all school-leavers are e-literate with sufficient foundational competence for further e-skills development.</td>
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<td></td>
<td>• Implement government service delivery strategies and plans on e-skills initiatives as integrated part of educational operations.</td>
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<td>• Tertiary institutions/ FETs should focus on skills that are in demand, align curriculum better to business needs.</td>
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<td></td>
<td>• Provision of free and accessible skills development, re-skilling and upskilling initiatives through government workshops and training sessions.</td>
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<td></td>
<td>• Stabilise the supply of electricity in PDAs.</td>
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<td></td>
<td>• Increase the number of conveniently accessible ICT centers and service providers.</td>
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<td></td>
<td>• Enforce measures to curb high crime rates within PDAs.</td>
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<tr>
<td>Small business owners (and employees)</td>
<td>• Attend e-skills training initiatives.</td>
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<td></td>
<td>• The small business owners and employees need to learn the general school curriculums (reading, writing and counting).</td>
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<td></td>
<td>• They need to take the initiative to approach the government agencies that provide e-support in order to gain the knowledge or information they require.</td>
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<td></td>
<td>• Elect community leaders responsible for mediation with government, thus these leaders can collect information regarding any grievances and provide it and preferred solutions to government.</td>
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</table>

**Conclusion**

The overall findings of the study confirmed that there was indeed a lack of e-skills among the small business owners and employees in the areas of empirical research (PDAs). Hence, the development of e-skills identified by this study is a must for e-supported development of small business in the PDAs. Furthermore, there was a lack of accurate information regarding the exist-
ence of the e-support as well as limited, convenient and cost effective access to ICT based resources. The combination of these factors directly influenced the poor use of e-support by the intended beneficiaries. It is strongly believed that addressing the identified challenges will encourage the increased and successful use of e-support.

The contribution of the study is seen as fourfold. Firstly, the study identified the prerequisite e-skills needed to fully utilise e-support. Secondly, the study documented challenges (barriers) faced by small business owners in regards to technology adoption. Thirdly, the study provided recommendations to government and small business owners (and employees) on how best to gain e-skills and address the identified challenges. Lastly, the study provides suggestions for future research.

![Figure 3: The use of e-support by small businesses and recommendations to government and small business owners that promote the increased use of e-support](Source: Authors)

Small businesses play a large role in the social and economic development (notably, poverty alleviation) of communities, especially those in PDAs. It is thus necessary to continue to provide the support that they require in order to ensure their continued success. Figure 3 highlights the current and desired positions in regards to the use of e-support by small business owners and employees. This figure also draws attention to the role of small business owners, as well as government in the provision of e-skilling initiatives, e-support and in addressing the challenges faced by small business.
It is noted that further research is needed in order to understand negative attitudes towards ICT, and how best to address such sensitive matters. The study did not cover all aspects that influence the adoption and utilisation of technology by small businesses in PDAs. It is necessary to investigate existence of other relevant e-skills factors (e.g., astute use of ICT and e-support services) in order to adequately address them. Furthermore, technology is continuously advancing, becoming more evolved - thus, methods of providing e-support, including the actual services might change (e.g., mobile or cloud computing services). Hence, it is necessary to continuously test the relevance of here identified e-skills. These e-skills might need to be adjusted accordingly from time to time in order to cater for the changes in the ICT arena and government service provision.

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Identifying the e-Skills Needed


Biographies

**Ms Natasha Katunga** is a researcher at the University of the Western Cape, where she also received her M.Com in Information Management. Her research focuses mainly on e-Skills and the use of ICT for socio-economic growth, particularly among people in previously disadvantaged communities. She is currently preparing her proposal for the PhD studies on the broad theme of e-skills for effective small business development in the context of the developmental state.

**Dr Zoran Mitrovic** is the Coordinator of the Masters in Information Management Programme at the University of the Western Cape, South Africa. He is the leading author of the South African National e-Skills Plans of Action (NeSPA 2010 and NeSPA 2013). His research and consulting praxis encompasses the development of e-skills in the developmental context, the use of ICT for local socio-economic development, e-government policies and praxis, and the use of ICT for environmentally sustainable development. He has been awarded for his research output.
Supporting a Humanizing Pedagogy in the Supervision Relationship and Process: A Reflection in a Developing Country

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Abstract

Research supervision should be treated with as much significance as teaching at undergraduate levels. Essentially, research supervisors are still dealing with students, about whom they have to be sensitive and aware, and the challenges they face in engaging with their doctoral study journey. As supervisors, it is essential that we apply a humanizing pedagogy in the supervision relationship to launch our students into becoming mature and capable researchers. The concept of a humanizing pedagogy is vital. In adopting this approach, the supervisor needs to become sensitive to the students they are supervising, and guide them towards a familiarity with the language of research and practical understanding of the skills of research within their discipline. This is especially vital in the South African and developing country context, as the students who enroll in these universities are often constrained by a number of factors, including their disadvantaged past and their cultural and social barriers. This paper presents a reflective discussion on an attempt to apply a humanizing pedagogy in the supervision relationship. Emerging academics who relate to this paper can use this reflection as an example to frame their own practice in applying a humanizing pedagogy in supervision.

Keywords: Humanizing pedagogy, collaboration, developing country, alienation, supervision relationship

NOTE: The full paper was published in the International Journal of Doctoral Studies, Volume 9, pages 73-83 and can be found at http://ijds.org/Volume9/IJDSv9p073-083Khene0545.pdf

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Understanding What Motivates Participation on Crowdsourcing Platforms

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Abstract

The need for innovation has become a top business priority for many Chief Executive Officers. Organizations have traditionally relied on their internal staff and upon traditional marketing agencies for new innovative ideas to handle the constant stream need for new products and services. One approach that organizations are now using is ‘crowdsourcing’. Attracting a large group of people to actively contribute ideas that will provide answers to an organization they are not employees remains a big issue. An understanding of what attracts the most effective contributors is therefore crucial. Crowdsourcing is an emerging field and it is still not well understood by a number of organizations in different countries and South African organizations are not an exception. To our knowledge, much of the literature has little mention on crowdsourcing initiatives in South Africa and also little on studies that have been conducted on platforms with a significant crowd workforce and project work representative of South African context. The focus of the paper is reviewing the literature and exploring some of the factors that should be considered when planning to outsource work to a crowdsourcing platform in order to attract contributors. A conceptual model is presented and some propositions for testing the model are presented.

Keywords: crowdsourcing, motivation, outsourcing, open call

Introduction

Crowdsourcing projects can span over long periods of time coupled with some tasks that may be laborious or repetitive, motivation of participants does not remain the same during this process. At different times of the process motivation varies as a result of different tasks being worked on and is salient during some activities and at its lowest during other activities. This means motivation of participants in crowdsourcing projects changes over time. Keeping participants motivated and engagement at all times during crowdsourcing projects becomes a challenge as this involves individuals from diverse backgrounds.

The new technological advances of the internet and its accessibility have seen the growth in internet communities. This has subsequently seen the coming together of people from different geographical locations and varying skills. Crowdsourcing activities have exploded in use in parallel to these developments of the internet and web tools.
Motivation for Participation

An understanding of what motivates participants in crowdsourcing projects becomes very important and will be the main focus of this paper.

What is Crowdsourcing?
Different researchers have come up with different definitions of “crowdsourcing” basing their definitions on different practices and contexts. The first definition coming from Howe was coined in 2006 and later revised in 2008. In his first definition he defined crowdsourcing as a way of taking a task that was previously done by an organization’s employee to a large network of potential laborers in the form of an open call. From this first definition the key aspects will be using an open call to connect with potential large network of potential laborers. However later on Howe further clarified his definition to include the fact that it will only be crowdsourcing once the organization fabricates it, mass produces it in high quantity and sells it (Howe, 2008). From this further definition, it is however not clear whether ‘fabricate’ is only restricted to production of physical goods or can be extended to making information available to a large audience without any reproduction costs over the internet.

Another leading researcher in the area of crowdsourcing Brabham has also his own versions of crowdsourcing. One of his definitions refers to crowdsourcing as being a web based business model for harnessing creative solutions of a distributed network of individuals through an open call for proposals (Brabham, 2008). Brabham also argues that his definition of crowdsourcing as a web based business model can also be used as a problem solving model thus addressing problems in other non-profit areas such as social and environmental problems.

Estelles and González listed 32 definitions from different researchers from their study and came up with a comprehensive definition based on eight characteristics of crowdsourcing;

“Crowdsourcing is a type of participative online activity in which an individual, an institution, non-profit organization, or company proposes to a group of individuals of varying knowledge, heterogeneity, and number, via a flexible open call, the voluntary undertaking of a task. The undertaking of the task, of variable complexity and modularity, and in which the crowd should participate bringing their work, money, knowledge and/or experience, always entails mutual benefit. The user will receive the satisfaction of a given type of need, be it economic, social recognition, self-esteem, or the development of individual skills, while the crowdsourcer will obtain and utilize to their advantage what the user has brought to the venture, whose form will depend on the type of activity undertaken.”

(Estelles-Arolas & Gonzalez-Ladron-de-Guevara, 2012)

We agree with the integrated definition provided by Estelle’s and González as this definition caters for the almost all different applications of crowdsourcing. An important point to note also is that the many different definitions from different researchers have been as a result of the diverse application of crowdsourcing in different areas.

Origins of Crowdsourcing
The term crowdsourcing could have first been mentioned in an academic paper in 2008 (Brabham, 2008) but open call contests are not new. In the 18th century an open call to the troubling longitudinal problem was extended to external experts by the British Navy. It was one of the most challenging scientific problems that saw a prize money of £20, 000 being offered to anyone providing a reliable solution. Despite Sir Isaac Newton having mentioned that only astronomical solution was the feasible method, the ultimate solution came from an unexpected unknown carpenter and clockmaker and his solution did not rely on astronomy (Spencer, 2012). This shows that crowdsourcing has been in existence long before the existence of the internet.
Advantages and Disadvantages of Crowdsourcing

Different researchers have debated the advantages and disadvantages of crowdsourcing work. In a study that focused on designing a framework that addresses the challenges in crowdsourcing work in different areas, Kittur et al. (2013) argued that crowdsourcing will continue to unlock new career opportunities in the cyberspace for skilled work but also highlighted that because of intellectual framing, crowdsourcing will become focused on low cost and exploitative labor. Comparing crowd work to traditional workplaces, another group of researchers, Silberman, Irani, Tomlinson, & Ross (2010) noted that there will be diminishing visibility and communication that has the potential of lowering the motivations of crowd workers and consequently affect the output from crowdsourcing. With very weak bonds and enforceable contracts, crowd workers have little power than in traditional workplaces and this can affect crowd relationship, workers’ lives and trust which is one key thing in crowd work.

For tasks that require 24 hours of input, crowdsourcing becomes the ideal solution. Crowdsourcing supports flexible pool of resources and helps alleviate scarcity of staff in some geographical locations. In the case of covering news 24 hours, the small core reports for CNN’s i-Report would not manage to keep news reporting updated in all the different corners of the world. As such they can rely on news content supplied by online contributors in different geographical locations where the actual events will be happening. CNN’s i-Report can just work on verifying and aggregating the content from online contributors. In this example, crowdsourcing makes use of online contributors located in different time zones thus enhancing the benefits of crowdsourcing. Furthermore it creates prospects for earnings in regions of the world where native economies may be stagnant. Crowdsourcing initiatives are usually delivered in a short time frame.

Whilst some people see opportunities for an income being created through crowd work, others are concerned with exploitation that has come with this phenomenon. Average hourly wages being offered on platforms like Mechanical Turk amount to US$2 and this is without any other benefits, worker protection or legal protection of the job and regarded as extremely low wages and exploitation of labor (Ipeirotis, 2010).

At the core of crowdsourcing is opening up the contest to anyone in the hope of getting exceptional, undiscovered talent from the large network of community contributors, but enormous number of contributors show up who may not be suitable or qualified for the available task to be solved. In paid crowd work, workers can submit low quality submissions in a way to try and generate more income. An example is on Mechanical Turk where an estimate of 30% or more of the submissions may be low quality (Bernstein et al., 2010). Selecting the best solutions from the vast amount of submissions in some instances can be a daunting task likened to looking for a needle in haystack. However, besides this challenge there are ways to assist in lowering this shortcoming whilst at the same time improving the chances of success with crowdsourcing (Parvanta, Roth, & Keller, 2013).

From this discussion it is evident that crowdsourcing can be a double edged sword that can enhance or diminish different aspects of our lives in society. However, despite some of the disadvantages noted in this discussion, it is the purpose of this study and other researchers to help unearth more of the advantages and positives of crowdsourcing through an understanding of what motivation is required that will lead to a sustained crowdsourcing initiative. The findings of the study will help engineers, managers, designers and scientists in designing the optimal incentives that will not only bring the best results but will also sustain crowd work.
Crowdsourcing Taxonomy

Crowdsourcing System
Crowdsourcing research has been conducted in many areas and one of the ways of looking at crowdsourcing is to view it as a system comprising of different components interacting in different ways. There are two types of performing crowdsourcing work. According to Zhao and Zhu (2012) crowdsourcing consists of three main components which include the organization that is seeking a solution (solution seeker) which is usually the one that initiates the process of crowdsourcing, large network of individual workers (the crowd or participants) which serves to provide solutions in response to a task and the third component being the intermediation platform (crowdsourcing platform) which acts as the link between solution seeker and the crowd. Furthermore, Kittur et al. (2013) also argued that a crowdsourcing platform is vital in managing the large network of crowd workers, tasks and solution seekers. In this first instance the core business of organization that is acting as the intermediary is to provide a link between the crowd and other organizations seeking solutions from the crowd. The core business of the intermediary company in this case is managing the crowd and organisations seeking external crowd participation and functioning as a market place. Crowdsourcing intermediaries act as platforms that network organizations and help them overcome skills shortage and lack of resources through linking them with suitable counterparts at the same time providing essential facilities for crowdsourcing activities (Zogaj, Bretschneider, & Leimeister, 2014). This study will be focusing on this setup which has an intermediary organization handling all the crowdsourcing management issues on behalf of the seeking organization.

However, some organizations whose core business is not crowdsourcing can manage their own crowdsourcing work that involves managing the crowd on their own (internal crowdsourcing platform). An example of such a setup is Dell’s IdeaStorm community which is used to harness ideas from its online users (Saxton, Oh, & Kishore, 2013). In this scenario there are only two actors; the organization seeking solutions and the crowd.

Figure 1 shows the two different scenarios just discussed.

![Figure 1 - Roles and mediation in crowdsourcing initiatives](image-url)

Source – Adapted from Zogaj et al. (2014)
Crowdsourcing Categorisations

Crowdsourcing is being used across different industries and as such there are different implementations to suit the different requirements. Different categories have been identified to define the different kinds of crowdsourcing. Various researchers have provided different alternative categorizations of crowdsourcing.

Zhao and Zhu in 2012 conducted a study on the current status of crowdsourcing research and analyzed 55 academic articles. In their study they reported that crowdsourcing can be better understood by examining both contexts and functions (Zhao & Zhu, 2012). Context being defined as being either business context or non-business context and function focusing on part of the product or service that is being crowdsourced (Vukovic, 2009). On the business context side this involves crowd work for profit making organizations whereas on the non-profit context includes organizations such as libraries, research and development, public libraries or citizen science (Savage, 2012). Function being further categorized by the nature and granularity of the task (Rouse, 2010). Figure 2 shows some of the examples of these categories.

![Figure 2 - Typology of crowdsourcing application. (Source: Zhao & Zhu, 2012)](image)

Another dimension to look at the different categorization (Zogaj et al., 2014) was to categorize them by the functions that they seek to address. They came up with the following functions; innovation development, design, development and testing, marketing and sales. This classification matches with the one from crowdsourcing.org which is one of the main sources of crowdsourcing insights and research. Some of the interesting categories include the labor category which represents crowd work that largely rely on crowd labor to complete repetitive and labor intensive tasks that cannot be done by a computer and can be broken down into smaller tasks such as sentiment analysis of tweets containing slang, language translation or other cultural aspects that cannot be processed by a computer algorithm. Crowdfunding category uses an open call to source funding for a project initiative. The project to be funded can range from music production, refurbishment of a school, humanitarian call to a malaria eradication project. This is a common place for new business start-ups and small entrepreneurs.

Figure 3 shows the classification by Zogaj et al. (2014).
Motivation for Participation

<table>
<thead>
<tr>
<th>Function</th>
<th>Intermediate</th>
<th>Description</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>Innovation development</td>
<td>InnoCentive</td>
<td>InnoCentive is an intermediary that organizes competitions for companies that seek for solutions in a specific field - often in areas like product development and applied science. The crowd predominantly consists of engineers and scientists that work alone or in teams and compete for cash payments or prizes offered by the crowdsourcing platform.</td>
<td>InnoCentive.com (e.g., Lakhani et al. 2007; Jain 2010)</td>
</tr>
<tr>
<td>Quirky</td>
<td></td>
<td>Quirky is a crowdsourcing intermediary which is specialized on innovation (especially new product) development. Crowdsourcing can ask for specific solutions regarding an existing product, or they can ask for ideas, prototypes and concepts with respect to completely new products. Within the community, quirk users (crowdsources) are able to collaborate regarding a specific idea or solution.</td>
<td>Quirky.com (e.g., Paulini et al. 2013)</td>
</tr>
<tr>
<td>Design</td>
<td>Threadless</td>
<td>Threadless is a popular crowdsourcing platform for the design of T-shirts. The designs are independently created by crowdsources. However, the Threadless community has the chance to evaluate submitted designs. In addition to the ongoing open call for design submissions, there are several design challenges centered around specific themes.</td>
<td>Threadless.com (e.g., Brabham 2010)</td>
</tr>
<tr>
<td>Crowdspring</td>
<td></td>
<td>Crowdspring is a crowdsourcing platform for graphic and web design. Here, crowdsources can work together to design different logos, ads or websites for crowdsources. Within one project, on average 110 submissions are posted by crowdsources.</td>
<td>Crowdspring.com</td>
</tr>
<tr>
<td>Development and testing</td>
<td>TopCoder</td>
<td>Software programming tasks are posted as contests. The developer of the best solution wins the top prize while other participants walk away with smaller rewards and garner skill ratings that can be included on their résumés.</td>
<td>Topcoder.com (Brandel 2008)</td>
</tr>
<tr>
<td>PASStrains</td>
<td></td>
<td>PASStrains offers a range of testing types for various software applications. It covers multiple platforms, devices, system configurations and country or region-specific aspects. PASStrains uses a global community of professional software testers.</td>
<td>Passbrains.com</td>
</tr>
<tr>
<td>Marketing and sales</td>
<td>LeadVine</td>
<td>At LeadVine companies can use the crowd for supporting their sales activities. The crowdsources post kinds of sales leads they desire, and pay their stated referral fee to the person who provides the lead. Hence, the community acts like a sales force.</td>
<td>Leadvine.com (Fute 2011)</td>
</tr>
<tr>
<td>Chaordix</td>
<td></td>
<td>Chaordix is an intermediary that provides crowdsourcing services for various kinds of tasks related to marketing activities, such as brand collaboration, marketing research, or new product development and promotion.</td>
<td>Chaordix.com</td>
</tr>
</tbody>
</table>

**Figure 3 - Classification of Crowdsourcing Initiatives.** (Source: Zogaj et al., 2014)

The nature of task can be used as another way of classifying crowd work. Rouse (2010) defined the nature of crowdsourcing work as falling into three categories namely simple, creative and complex tasks. Simple tasks will have crowd work that is of relative low complexity and does not require specialized skills or education to be tackled. This includes tasks like copy and pasting pictures or text, classifying images of vehicles as either right-handed or left-handed, data collection or rating (Parvanta et al., 2013). Creative task category was defined as having tasks that are neither complex nor simple and require some skill like logo design or t-shirt design. The last class was defined as complex and involves specialized skills and education in sophisticated domains like software development or aircraft engineering and requires deep knowledge and understanding in the specific areas. Likewise, Schenk and Guittard (2009) also defined the same groups based on the nature of crowd work as another way of classification similar to Rouse (2010).

**Related Work**

**Outsourcing**

Some researchers have defined crowdsourcing as a form of outsourcing and drew a lot of similarities between the two. Outsourcing is defined as the decision by a company to contract a task to a third party vendor who in exchange provides and manages the task or service for financial gain over an agreed period of time (Kern, 1997).

In a study on trying to unpack and get a better understanding of crowdsourcing, Rouse (2010) defined outsourcing as the act of assigning work or tasks to an external service provider. In the definition the author further explains outsourcing being categorized into three areas mainly simple outsourcing, outsourcing of IT services and outsourcing of business processes. From this the author takes crowdsourcing as a particular form of outsourcing. This definition shows that there are areas of similarities however there are other key differences that exist between the two and as such not all motivations from outsourcing are transferable to outsourcing. One of the key differ-
ences between outsourcing and crowdsourcing is that prior to rewarding or paying the person who has completed the task in crowdsourcing that person is not known.

**Studies on Motivation and Engagement**

Understanding what motivates crowd workers to participate always pose a consistent challenge to the design of crowdsourcing platforms. Jakob Nielsen conducted a study on online communities and concluded that only a small fraction of the users is actually involved in contributing the majority of the contributions. The majority of the users only ‘lurk’ in the background (Nielsen, 2013). It becomes very useful that the motivators to participation need to be deeply understood. This understanding of motivation requires also an understanding of the psychological dimensions of motivations.

A lot of studies have been done on motivation in different contexts. Deci and Ryan in their research on human motivation outline and present the Self-Determination Theory which is an empirical theory that differentiates between intrinsic and extrinsic motivators. Their theory addresses also the social aspects that can either enhance or diminish the different types of motivation. Their theory has been used in studying online human behavior in different communities. They define intrinsic motivation as performing a task for its inherent contentment rather than for some separable consequence (Ryan & Deci, 2000).

**Crowdsourcing in South Africa**

Although crowdsourcing has been cited as a new phenomenon, several companies in South Africa have joined in the crowdsourcing movement. There has been very little that has been written about some of the crowdsourcing initiatives that have been accomplished in South Africa. Some of the following organisations that have been involved in crowdsourcing initiatives include BMW, Vodafone, FNB Premier Banking and Capitec Bank through a crowdsourcing intermediary called Idea Bounty. All these companies were seeking ideas from world over for their South African market and turned to crowdsourcing for the solutions. Capitec Bank put up an open call for one print and one banner advert concept and put an incentive of U$5,000. More than 600 submissions were made and the bank had to select the best solution and the reward was awarded to the winning concept. Looking at these organisations the award they offered on average was U$5,000 which is roughly around R50 000. However winning did come with some bit of controversy as some of the participants were asking the choice and criteria of the winning concept (Wyngaard, 2014). This makes the crowdsourcing initiative no different from other contests. Since crowdsourcing has been described as being in its infancy an understanding of the motivators of participation will help in future work by some of these organisations not only to improve the process of selecting the winning contribution but to keep crowd workers fully engaged and motivated to contribute more. This makes our study vital at this point.

IBM working with some local South Africa city councils launched a crowdsourcing initiative where citizens participate even via mobile phones to report water leaks, faulty water pipes or general conditions of water facilities. The project was launched in September 2013 and will see the change on how local authorizes and citizen participate in matters that affect their day to day lives. Another marketing type of crowdsourcing initiative in South Africa that received a lot of support is the Carling Black Label challenge which relied heavily on the huge support base of South African soccer fans. In this crowdsourcing initiative, the fans were presented with a chance of selecting the players they wanted to see play through peer vetted ratings. This was done for the two soccer giant team in South Africa. More than 11 million votes were recorded for player vetting and the initiative has now become an annual event due to its popularity.
Motivation for Participation

These examples show that there will be a natural increase and consequently increase in competition for crowd workers as the numbers of crowdsourcing intermediaries emerge and it will only be those platforms that understand what motivates crowd workers and how to engage them that will thrive. Furthermore, crowdsourcing intermediaries that will manage to align the motives of the crowd workers with long term goals of crowdsourcing initiative will win.

Propositions

As the accessibility and affordability of internet access continues to improve in South Africa and across the world, so will be the amount of crowdsourcing initiatives on the internet. In addition to this, there will be an increase in the competition for crowd workers. An understanding of motivation that will keep the crowd engaged and contributing becomes vital.

It is from this background that the author proposes the following to be tested empirically. Comparing differences in motivations by studying engagement when the following incentives are presented to the crowd workers;

- **Proposition 1**: 10 South African Rands in cash;
- **Proposition 2**: 10 South African Rands in a tangible reward (cup of coffee)
- **Proposition 3**: 10 South African Rands in a common good (all money collected and given on charity or something is done locally).

Conclusion

Motivation of participants poses a huge challenge on online communities and crowdsourcing is not an exception. With the enhancement and development of internet technologies more online activity is increasing. This in turn will see more organisations turning to online communities for solutions. An understanding of crowd motivation and engagement becomes vital and will help in knowing when likely a participation is about to disengage and help in correcting or creating a conducive environment for participation. This study will help organizers and architects of crowdsourcing projects to be aware of what motivates the crowd and be able to provide a mix of conditions that the crowd will thrive. In aggregate literature suggests that the effectiveness of crowdsourcing is significantly influenced by the state of worker attention and engagement.

Although crowdsourcing can be said to be in its early stages it is worth assessing with an open mind the unexpected applications that can benefit an organisation. Organisation should start fostering a culture of experimenting with crowdsourcing keeping security, privacy and compliance risks low.

Acknowledgements

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References


Motivation for Participation


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![David Machine](image)

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![Jacques Ophoff](image)
A Blended Learning Approach to the Professional Development of TVET College ICT Educators: A Case Study

[Abstract only]

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Abstract

The South African Technical and Vocational Education and Training (TVET) sector introduced new career-oriented qualifications in 2007. The throughput and retention rates for the National Certificate (Vocational) in Computer Science and Information Technology were low from inception. It was soon recognised that the low level of lecturer qualifications and lecture quality were among the factors contributing to this problem.

A Professional Development Programme was designed as a pilot intervention to enhance the teaching capacity of these lecturers. Its overall goal was to equip participants with the theory and principles of education while blending theory with praxis to ground the learning environment in the reality of teaching the curriculum. The programme was delivered using a blended learning approach, and, as it was a pilot designed as an urgent intervention, it followed the principles of a negotiated curriculum. This research comprised the monitoring and evaluation of the programme both internally and externally and was designed to ascertain the extent to which the programme was successful in assisting the lecturers in improving their delivery of the syllabus.

This paper reports on the findings from both internal and external evaluations, discusses their significance within the context of the research and makes recommendations for future practice within the TVET College sector.

Keywords: TVET, teacher professional development, negotiated curriculum, blended learning
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Factors that Influence Misalignment between Developers and Testers in Agile Organizations, and Alleviation Strategies Employed

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Abstract
The concept of alignment has been addressed in the context of business and information technology (IT) domains within organizations, but very little research has investigated the alignment of roles within units in an organization. Within the IT domain, research shows evidence of misalignment between the role of the software tester and the software developer in software development teams, specifically in agile organizations that adopt agile methodologies. Much research on this topic focuses on managing the problem and preventing the problem, but not alleviating it, because there is insufficient literature that investigates the factors that influence misalignment. The purpose of this paper therefore is to identify through a comprehensive literature review the factors that lead to misalignment between developers and testers, and to hence recommend strategies to alleviate the problem of misalignment.

Keywords: Misalignment, influence factors, developers, testers, agile organization, alleviation strategies

Introduction and Problem Statement
The relationship between developers and testers in information technology (IT) organizations is a subject of concern because studies have revealed that there is poor collaboration between the two parties (Dhaliwal, Onita, Poston, & Zhang, 2011). Moreover, developers and testers have very conflicting roles despite the fact that they are expected to work closely within their subunits (Zhang, Stafford, Dhaliwal, Gillenson, & Moeller, 2014). It is important for developers and testers to have a good working relationship because the work they do is critical to the success of agile organizations – i.e. IT organizations that employ agile software development methodologies. It is important to ensure that there is collaboration, cohesiveness and communication between these two parties (Cohn, Leffingwell, Larman, & Vodde, 2013). Davis (2014) suggests that managers of software development teams should emphasize the importance of teamwork and reiterate that every member of the software development team has an important role to play in ensuring the quality of the end product. The aim of the study is to investigate the factors that influence the misalignment between developers and testers in agile
organizations and subsequently explore the strategies that can be implemented to alleviate this problem. Prior research has mainly focused on managing the problem and preventing the problem but not alleviating it (Zhang, Stafford, Dhaliwal, Gillenson, & Moeller, 2014). The study discusses how alignment between developers and testers is articulated (Onita and Dhaliwal, 2011). The study then explores various underlying factors that lead to conflict between developers and testers, and suggests alleviation strategies.

**Agile Methodologies and SCRUM Roles**

Contrary to the traditional-plan driven organizations, agile organizations are concerned about people and collaboration rather than procedures and tools; software that works rather than extensive documentation; building customer relationships rather than negotiating contracts; and being change-driven rather than following a rigid plan (Wilson, 2013). Agile methodologies are defined as lightweight software development methods that have been introduced as a counter to the failures experienced with traditional software development methods (Popli & Chauhan, 2013).

The agile methodology is composed of various methodologies that can be used by software development organizations to effectively manage their projects, such as eXtreme Programming (XP) (Beck, eXtreme Programming Explained, 2000), SCRUM (Lyssa, 2011), and Dynamic System Development Methodology (DSDM) (Stapleton, 1995). The focus of the current research will be on the SCRUM methodology.

The SCRUM methodology suggests the creation of SCRUM teams composed of the following roles: 1) Scrum Master – the scrum master is responsible for removing any impediments or obstacles that may affect the successful completion of work in the team. 2) Product Owner – the product owner is responsible for communicating all the requirements of the project work as expected by the customers and for communicating the time lines associated with implementing the work to the team. 3) Team members – these are self-organizing teams from various functional units of an organization which are responsible for the development and testing of the work. Usually this group of people should be between 4 and 9 individuals in order to maximize productivity without jeopardizing the quality of the product. The developer and tester would fall in as team members (Schwaber & Sutherland, 2011).

**Role of Developers and Testers in SCRUM teams**

Software developers are usually involved in the software development lifecycle (SDLC) from the planning until the maintenance phase, because they initially meet with the customers or end users of the software they intend to develop. In these meetings they discuss the requirements of the customer and whether or not these requirements are feasible. Thereafter all the requirements are documented and forwarded to the programmers who in turn write the code. The code is then tested by software testers and if any bugs or issues arise, these are sent back to the programmers. This is done until the software developer is satisfied with the software, which they then demonstrate to the customer. If the customer is satisfied, the product is officially released (Bureau of Labor Statistics, 2014).

Software testers evaluate the quality of the software that has been developed by software developers to ensure that it meets the requirements as specified in the requirements specification document. Software testers usually join the SDLC at the implementation stage, once all the development has taken place and the software is ready to be tested. Software testers are responsible for ensuring the overall quality of the software has been met, and prevent software to be released if it is not free of bugs, errors and other problems (Bureau of Labor Statistics, 2014).

Conflict often arises between developers and testers in SCRUM teams. This conflict arises as a result of the conflicting roles, objectives and skill sets of the developers and the testers. The de-
veloper is responsible for designing the software as specified in the requirements specification, developing the code for the software and making sure that the software does what it has been set out to do; the testers’ responsibilities involve identifying flaws, bugs or problems in the software that the developers have produced and overseeing the quality of the end product (Zhang, Stafford, Dhaliwal, Gillenson, & Moeller, 2014). The developer aims to design and develop working software efficiently while maximizing resources and minimizing the time used for the whole development process. Testers on the other hand strive to ensure that the software produced does not only work, but that it is of acceptable quality and effectively does what it has been set out to do (Zhang et al., 2014).

Misalignment in Software Development and Testing

Prior to discussing misalignment in the software development context it is worthwhile to investigate the various terms which also refer to alignment. Ullah & Lai (2013) refer to alignment as the fit between the business and IT strategy as well as a fit between the business structure and the IT structure. Chan & Reich (2007) refer to alignment as a link, thus defining alignment as the link between business plans and objectives and IT plans and objectives. Chan & Reich (2007) also refer to alignment as the degree of congruence between IT strategy and the business strategy. All these references to alignment conceptualise it as a state between business and IT. Baljit (2013) refers to alignment as the process of improving communication between the strategic decision makers of a business and the IT decision makers in order to bridge the gap that is created by differing roles, goals and values between the IT managers and executive managers. Misalignment on the contrary would be defined as the opposite of alignment – i.e., the breakdown in communication between IT decision makers and business decision makers. This misalignment concept can be applied more specifically to the case of the breakdown in communication that occurs between developers and testers.

Onita and Dhaliwal (2011) propose a developer-tester alignment (DTA) model to explain the importance of alignment between developers and testers. This model draws from notions that are extracted from the business-IT alignment model and thus the DTA model defines alignment as follows: “Alignment between development and testing strategy/capabilities can be defined as the strategic and operational fit between a firm’s development and testing functions” (Onita & Dhaliwal, 2011, p. 50). The DTA model focuses on establishing some form of common ground between developers and testers because both parties cannot succeed in achieving the objectives of the IT function if they do not work as a team and support each other in doing their work. Figure 1 illustrates the DTA model as discussed by Onita and Dhaliwal (2011):

The DTA model in Figure 1 proposes that the development and testing strategies (Q1 and Q2) need to be aligned in order for the two subunits to successfully meet the objectives of their subunits. If the strategies between the two subunits are not aligned, this may result in a deviation from the direction that should be taken to reach the goal. The arrow numbered 1 shows the alignment of the two strategies. Secondly, the model suggests that the development capabilities and the testing capabilities (Q3 and Q4) should also be aligned in order for the subunits to work effectively together, otherwise the mismatch in capabilities may cause a breakdown in their work relationship and adversely affect the goal. The arrow numbered 2 shows the alignment of the capabilities. Thirdly, the model recommends that there should be an alignment in how the development division executes their strategies and capabilities. In order to implement the processes, skills and architecture for development, the relevant scope, governance and resources must be in place to support the implementation of the above capabilities otherwise there will be a misalignment between these two concepts (Onita & Dhaliwal, 2011).
Factors that Influence Misalignment between Developers and Testers

In order for the developer and the tester to collaborate and communicate effectively, they need to be placed in close proximity in the agile organization which means that they must be placed in one SCRUM team (Cohn et al., 2013). Having a developer and a tester in one SCRUM team has raised the argument of whether a tester is necessary or not in the team because developers do somewhat test their work before it is officially released to production environments (Sumrell, 2007). The need has been identified for testers to form part of a SCRUM team because the testing that the developers do relates to the units of the code that they have developed and not to the overall finished product - code may be correct, but that does not mean that the overall functionality works according to the specification (Sumrell, 2007). Factors identified as contributing to misalignment will be discussed next.

Lack of Communication

Lack of communication between developers and testers in project teams plays a big role in contributing to the conflict between these two parties. Organizations should identify strategies that will create an environment where communication, knowledge sharing and collaboration can be easy between these two parties (Zhang et al., 2014). Since both developers and testers play an important role in ensuring that the quality of the software product is satisfactory, there ought to be a sense of togetherness and unity in their work ethic. Miscommunication between them has adverse effects on achieving the strategic objectives of the IT unit (Ammann & Offutt, 2008).

Zhang et al. (2014) propose a three-layer conflict model which depicts the factors that influence the conflict between developers and testers. The three-layer conflict model is illustrated in Figure 2.
The model infers that the source of conflict stems from three components: process, people and lack of communication, but centrally lack of communication.

**Poor Collaboration**

Marczak & Damian (2011) emphasize the importance of collaboration, coordination and communication specifically in a software development team to ensure the success of a project. Poor collaboration between those involved in performing the core tasks in the software development team could result in a failure of the project. Hence poor collaboration between developers and testers contributes to misalignment (Ammann & Offutt, 2008).

**Process Non-Compliance**

The three-layer conflict model of Zhang et al. (2014) suggests that developers ought to be efficient in updating bug tracking tools and in informing the testers of changes or updates to code. Developers often struggle to comply with the processes set out for the team. Non-compliance with process contributes to misalignment.

**Differing Mindsets**

The mindset of a developer or tester will contribute immensely to the conflict between these two parties. This is due to the fact that the developer or tester will join a team with one or more of the following attitudes towards the other party: “1) You don’t know much about what I do so I’ll keep you in the dark or disregard you until you just go away, 2) I don’t like the fact that you are in this team. I will strive to keep you off my back as far as possible, 3) I know there is a good reason for you being in this team and that I should be haste in my work to let you catch up but I will not worry myself about you, 4) I don’t like the way you code, Your testing is useless” (Lagestee, 2013). These attitudes impact the relationship between developers and testers in a negative way and should be eliminated before they cause further harm to the team structure (Lagestee, 2013).

**Blaming**

The level of experience, knowledge and skills of the developer and the tester may not always be aligned. This can result in a conflict between the two parties because the way the two parties will
understand and apply the work will be determined by these factors (Zhang et al., 2013). It is important for the two parties to be aware of such differences and find ways to work around them. Due to the fact that software testers do the final testing before a product is released to the production environment, they are often blamed when bugs or issues are found in the production environment and the developers are usually safe from the blame (Lagestee, 2013).

**Strategies to Alleviate Misalignment between Developers and Testers**

Table 1 illustrates strategies that can be employed to alleviate the sources of misalignment between developers and testers. These include regular meetings (Marczak & Damian, 2011); creating an environment to facilitate communication (Zhang et al., 2014); developing a shared understanding (Jasbir et al., 2011), and both parties agreeing to take full responsibility (Lagestee, 2013).

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<tr>
<th>No.</th>
<th>Factors influencing misalignment</th>
<th>Reference/s</th>
<th>Strategy to alleviate factor</th>
<th>Reference/s</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>Poor collaboration between the two parties.</td>
<td>Marczak &amp; Damian (2011)</td>
<td>Physical gathering – weekly or daily meetings.</td>
<td>Marczak &amp; Damian (2011)</td>
</tr>
<tr>
<td>5</td>
<td>Blaming one another when quality of software is poor.</td>
<td>Zhang, Dhallwal, Gillenson, &amp; Stafford, 2013 and Lagestee, 2013</td>
<td>Shared understanding of objectives and good match of skills. Both parties must agree to take full responsibility for the quality of the end product,</td>
<td>Jasbir, Collin, Robin, &amp; Xihui (2011) Lagestee (2013)</td>
</tr>
</tbody>
</table>

**Conclusion**

From the literature review, the author identified that prior empirical research that has addressed the conflict or misalignment between developers and testers is not very context specific. Some of the literature addresses this problem in traditional-plan driven organizations whilst the literature that does refer to agile organizations does not specify that the developers and testers must be in the same location, part of the same team and must be expected to communicate and collaborate effectively. Additionally, the literature that discusses misalignment within agile organizations does not refer to agile organizations that are using one or more of the agile methodologies to manage their software development projects. The literature also reveals that most studies that propose strategies to address this problem do not come up with preventative measures but rather with measures that can manage the problem. It is evident that this approach has not been very successful because current research reveals that the factors which influenced misalignment between developers and testers a decade ago are still prevalent nowadays. Further research needs to be done in agile organizations to investigate why the misalignment between developers and test-
ers is still prevalent, but this research should be more context specific rather than general and the research should aim to identify how to alleviate the factors that cause this misalignment.

References


Biographies

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Evaluating the Effectiveness of Elearning and Core Skills Interventions for South African Secondary School Learners

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Abstract
This case study investigates a multi-faceted initiative by the MMI (Metropolitan Momentum Initiative) Foundation for Grade 11 and matriculation learners designed both to improve the learners’ mathematics, science, and English grades necessary for university admission, and to improve the learner’s core skills in order to enable their transition from secondary school to university. These core skills, presented in an intensive five day workshop, include communication, problem solving and conflict resolution skills. This initiative was evaluated through the use of questionnaires and focus groups (to evaluate the learners’ perceptions of the grade improvement programme), grade analysis (to determine the level of improvement that the grade improvement programme had on school grades), and interviews (to determine the programme participants’ perceptions of the effectiveness of the core skills workshop). The results of these evaluations are presented and then discussed. The participants felt that the core skills workshop and eLearning programme were generally useful, with some challenges, and it was determined, through grade analysis, that the programme did help students increase their marks in the selected subjects significantly, although some students improved more than others.

Keywords: eLearning; intervention; core personal skills; South Africa; e-skills, case study

Introduction
The MMI Foundation is devoted to helping disadvantaged students succeed in secondary school in order to gain admission to and remain in university. One of these initiatives, tutorial sessions, began approximately three years ago. This programme is funded by MMI Foundation and tutorials run every Sat-
urday on e-platform for six hours at various Universities in South Africa. These tutorials consist of a self-regulated eLearning session. The Durban-based group began with a group of Grade 11 learners from schools in disadvantaged areas; teachers at each of the schools in these areas, in compliance with the professional body’s selection criteria, selected three learners from their school who had the best potential to achieve a final average grade of A in the South African subjects of English, physics, and mathematics (Reddy, 2003).

In order to help students overcome some of the personal issues arising from the transition from home/secondary school to university life, an intensive five day workshop was held for matriculation students in order to teach them core personal skills, such as communication and problem solving skills along with techniques to adapt to personal changes in their lives.

In this case study, we investigate the effectiveness of the tutorial sessions (both from a secondary school grade improvement and a student perspective) and the workshop (from a student perspective) using different methods of individual interviews and questionnaires, empirical analysis of grades, and a focus groups interview of all participating learners.

Background

**Literature Review of eLearning Initiative**

High mathematics and physics grades, along with an ability to communicate well in English, are a pre-requisite for most technical programmes at universities. However, the majority of South African school children have difficulty in achieving these criteria. In international assessments, a small majority, 10% of South African students in mathematics and 13% in science, score higher than the Low International Score (Reddy, 2003). Attempts to resolve this issue of low math/science scores is problematic because a combination of factors, rather than a simple single factor, has been identified.

Simkins (2011) describes South Africa public education as a low-quality mass system with standardized test results being uniformly poor. An example, in 1999 and 2003, the nation’s pupils came last in the Trends in International Mathematics Study. Although teachers are required to deliver 22.5 and 27.5 hours of instruction per week, a 2005 Department of Education study discovered that the number of hours of instructions in the classroom averaged only sixteen hours due to early departure and little teaching on Fridays (Simkins, 2011). Of the 7 000 secondary schools in South Africa, 10% of these schools produce 60% of university-eligible pupils (Mouton, Louw, & Strydom, 2013). Other issues identified as plaguing the South African school system include poor teacher training, insufficient departmental support, lack of teaching resources, overcrowded classrooms, and administrative overload (Meyer & Warnich, 2010).

A number of possible solutions to these problems have been proposed, including instruction through eLearning. ELearning is a web-based or electronic system that allows knowledge to be provided to learners without regard to time or geographical restrictions (Sun, Tsai, & Finger 2008). By providing consistent delivery of expertly-planned material at a student’s own pace, it enables students to pursue their learning outside the traditional school infrastructure and hours (Lee, 2005). Through the provision of multi-media, students receive a richness of instruction through eLearning that is not often provided in traditional teaching. By allowing simulated learning, students are provided with the opportunity of having new learning material first presented to them and then apply it in a practical manner repeatedly until they are successful. After successfully completing a unit, the students are assessed on their understanding of this material (Lee, 2005). Each e-learner has access to the same resources and materials as the other and provides more effective individualized instruction (Wu, Tennyson, & Hsia, 2010) It provides an environment for low-performing and high-performing students to learn through alternative methods of
delivery and personalised instruction. E-Learning has evolved from standardized packages of content to one that can be creatively customized to suit individual preferences and learning styles. In this way E-learners can feel more in control of their learning and learning environment (Downes, 2005).

The importance of E-Learning as a tool of learning has been identified in relation to its measure of effectiveness (Lee, 2005). In order to evaluate the effectiveness of teaching methods, Kroesbergen and Luit studied educational pedagogies, including peer and self-instruction, and found that self-instruction was the most effective method for learning (Downes, 2005; Kroesbergen & Luit, 2003). Computer-aided instruction, in turn, was found to be the most effective within the various forms of self-instruction (Xin & Jitendra, 1999). As the basis of e-Learning, computer-aided instruction provides individualised instruction which enables students to take charge of their learning and to proceed at their own pace (Lee, 2005).

Self-regulated learning is a subset of e-Learning where individual pupils have control over their e-Learning (Lynch & Dembo, 2004). A definition of self-regulated learning might be learning efforts that manages and directs complex learning activities. This type of learning involves three parts of cognitive strategy use, meta-cognitive processing, and motivational beliefs (Kaufmann, 2004). In a self-regulated learning environment, students are in control of their own learning by selecting and setting their goals and by using individual strategies to monitor and control the various aspects which influence the learning process and evaluating their own actions (Järvelä, Nääkkä, Laru, & Luokkanen, 2007; Lee, 2005).

Some studies indicate that the cognitive self-regulation strategy of organizing and transforming, as a core part of self-regulated learning, serves as a significant predictor of students’ course grades in mathematics and other technical subjects of secondary school (Nota, Soresi, & Zimmermann, 2004). Successful students in an online course will typically use self-regulated learning strategies with a statistically significant performance improvement (Yukseturk & Bulut, 2007). Studies have demonstrated that in conditions where students have more control over their learning result in larger learning gains than where students learn under instructor-led conditions (Caşvus & Ibrahim, 2007; Gao, 2003).

However, this is not to say that self-regulated learning is advantageous for all students, given different learning styles. Some students experience difficulty adjusting to the structure of online courses and in managing their time (Marino, Eager, & Draxler, 2000). The absence of an instructor, along with more responsibility of the student to effective engage in learning activities, will often create difficulties for some students, especially those students with low self-regulatory skills (Dabbagh & Kitsantas, 2005). Dependent students, who are less self-regulated and need frequent direction from a physically present instructor, may feel frustrated using an online course. These frustrations may be reduced if this online course is combined with regular opportunities for face-to-face instructor interaction (Rovai & Jordan, 2004).

Ozkan (2005) identified factors in e-Learning effectiveness such as system quality, content quality, and students’ perceptions of the programme’s effectiveness. Chu (2008), in his story of Chinese university students, found that prior IT experience and their competence affected their e-Learning effectiveness. Menchaca and Bekele (2008) identified e-learning effectiveness with factors of human perceptions and competences, course design, institutional features, and technology aspects. E-Learning effectiveness was evaluated by Johnson et al (2009) as composed of different variables such as technology aspects, students’ characteristics, and students’ metacognitive abilities. Ordonez (2014) evaluated multiple models designed to measure the effectiveness of e-Learning in different countries. The most common factors within these models were technological infrastructure, institutional support, student satisfaction, and determination of the degree of knowledge transfer through e-Learning. The role of the Internet mediates the former need for peer
support in learning (Ordenez, 2014). According to, Tsai, and Finger (2008), there are thirteen factors, within various dimensions (instructor, learner, design, environmental, course, and technological), which contribute to e-learner satisfaction. The learner dimension includes learner’s anxiety, internet self-efficacy, and their attitude toward computers. The instructor dimension includes instructor response times and their attitude toward e-Learning. The design of e-Learning contains its perceived usefulness and ease of use among students. Technology would encompass technological quality and Internet quality. The course dimension consists of course flexibility and the environmental dimension looks at assessment diversity and student’s perceived interaction with others (Sun, Tsai, & Finger 2008).

Measuring e-learner satisfaction is critical to determine the effectiveness of e-Learning and to ensure that pupils continue on with their e-Learning (Ozkan, 2005). Measurement of this satisfaction has been accomplished through pre and post test experimentation, focus groups, questionnaires, and interviews (Lee, 2005).

**Literature Review of Life skills Workshop**

The University of Cape Town in South Africa designed and ran a number of life skills workshops for communities (Rooth, 2002). These workshops focused on various themes (Assertiveness, Communication, Change Management, Racism, Goal Setting, Health Management, Motivation, Self-Concept Enhancement, Stress Management, Team Building, Time Management, Developing Empathy and Understanding) which would be selected and adapted to the student group’s needs. These workshops were based on experiential learning and on in-group interactive processes. Experiential learning is rooted in learning from direct experience and reflecting on those experiences. Students of these workshops are encouraged to become actively involved through the use of storytelling, role-play, music, and art in order to increase participation and to incorporate different learning styles. Rather than focus on the end-product of problem-solving, students were encouraged to look at the process of problem-solving which involves unleashing creativity, encouraging lateral thinking, and develop methods to enhance creativity to discover solutions to problems. The majority of students were from disadvantaged areas and included health workers, community workers, teachers, and potential future facilitators. Using questionnaires to evaluate the post-event effectiveness of the workshop, the results seem to indicate that the workshop enabled the students to have a stronger sense of control over their immediate environment, the ability to make changes when necessary, and a stronger ability to devise solutions to problems as they arose. The focus of problems in the environment in the students’ minds shifted from those dismissed as “out of their control” to those which should be considered as they may have a feasible solution. (Rooth, 2002)

Life skills can be classified as behavioral (sharing), cognitive (optimal decision-making), interpersonal (effective communication), or intrapersonal (goal setting). Many over these skills can be developed through sports or other participatory activities. Team-building activities where students are encouraged to enhance communication, to know each members’ strengths and weaknesses, to set goals and to share dreams, and to evaluate these goals for their feasibility are conducted. Any roadblocks to achieving their feasible goal are identified and, using a problem-solving strategy, solutions to resolve these difficulties are found. The art of managing emotions is demonstrated as a way to relax and remain in control of the situation (Theokas, Danish, Hodge, Heke & Forneris, 2008).
Interventions

Self-Regulated ELearning

This intervention consisted of a series of self-regulated e-Learning tutorials in mathematics, English, and physics for a group of select secondary school students. This intervention was funded by the MMI Foundation and operated through the KZN e-Skills CoLab in Durban. These tutorials operated for six hours every Saturday during term times at a South African university. In compliance with the professional body’s selection criteria, teachers at each of the schools within a large radius of this university selected three Grade 11 learners from their school who had the best potential to achieve a final average grade of A in the South African subjects of English, physics, and mathematics.

A pilot project for this programme began with traditional instruction in these subjects using textbooks but the end results were not encouraging. Consequently, the project then adopted an online learning platform, Sivayula (for mathematics and physics) and Potential Unlocked (for English), which operated on laptops provided by the funding body. An administrator, who manages administrative and logistic issues, and a mentor, who is present in the classrooms at all times, was supplied by this funding body. The e-Learning platform provided instruction using texts and figures, videos, and simulations; this instruction allows students to learn at their own pace. An online tutor is available for students to ask questions on the material and to receive answers. Regular online quizzes assess students periodically on the material that they learnt.

Core Skills Workshop

The Core Skills Workshop was an intensive five day workshop for Grade 12 (matriculation) students that focused on developing their skills in communication, building relationships, networking, conflict handling, change and resilience, self-esteem, personal values, problem solving, and decision making. Utilising Goleman’s 4 box model, the relationship between self-awareness and social awareness with self-management and relationship management was demonstrated and explored. Different methods were used to acquire different skills in this workshop. An example, role-playing was used to demonstrate how to handle conflict; changes in a dance routine were used to demonstrate how to incorporate and adapt changes in one’s life (Skills for Life, 2013).

The content of these workshops were developed using various input sources, such as expert advice, reflective learning from past workshop experience, et al. One of these sources were the results of interviews from first and second year tertiary students who advised on the relevance of the content. This workshop was conducted utilising the experiential learning approach which incorporated students’ strengths of participation, dancing, and acting and entailed engagement between students and tutors. Use was made of Tension Release Exercises, such as yoga, which were introduced as a self-help tool to help students deal with stress. These exercises were appreciated towards the end of the day after a full day of workshops. In terms of role-playing and games that would engage the student, the students were told of the games rule before the start of game in terms of expected behaviors in this learning environment. A Facebook page was developed for this core skills workshop in order to provide an equal platform for all to communicate interactively in a form that is familiar to students (Skills for Life, 2013).

A core and consistent thread in the programme was the encouragement of accomplishing the students’ goals and protecting their dreams, in spite of the many envisaged challenges that will come across their paths. Also, the workshop re-enforced and promoted of attitudes and behaviors that will lead to success of its students (Skills for Life, 2013).
Objectives

This case study had several objectives. Each objective had the same goal: to evaluate the effectiveness of the eLearning programme and core skills workshop to ensure that the students were both academically and personally prepared for university life. From the perspective of the funders, they wished to know if their eLearning initiative was effective in their original goal: improving students’ mathematics, physics, and English scores at their respective secondary school in order to qualify them for university entrance. Another objective in regards to the eLearning program was to determine, from the students’ perspective, if this programme helped them to achieve their goals and in determining what aspects of this programme might be improved for future students. The objective of the core skills workshop was to prepare the grade 12 students for the envisaged challenges they would be facing in their transition from a high school environment to a tertiary education environment.

Study Procedures

In order to evaluate the eLearning programme, from two different perspectives, and the core skills workshop, different research methods were considered until the most suitable ones were chosen and employed. An initial pilot study of students in the eLearning programme, which the researchers did not participate in, had given some indications of students’ perceptions of the programme but the researchers wished to explore their perceptions of the programme in more depth and using more themes. As the number of the students was quite small (around 30), a questionnaire method would likely result in too much of a bias and it would be unable to explore our themes in depth. Only a certain amount of time was given to us by the programme sponsors to ensure that their programme operation was not interrupted. Using an individual interview method would take too much time – more time than was allocated to us. Consequently, it was decided to select the focus group method as being best able to collect individual viewpoints from a small group of students. A focus group approach was used by Ozkan (2009) with 20 students to obtain and enhance students’ viewpoints on an eLearning programme. In regards to grade improvement vis-à-vis the learning intervention, a few different methods were considered. A quasi-experimental approach, with test and control groups to reduce any biases within groups, with measurement of improvement in grades for the test groups was viewed as infeasible due to the difficulty in determining and accessing a control group. Another problem with the quasi-experimental approach is that design is useful, in studies such as conducted by Lee (2005), to measure goal-achievement within a tight time frame. However, this programme served as a supplementary to year-long secondary school programmes; if a quasi-experimental approach was used to measure the programme’s effectiveness, there would be difficult in differentiating the influence of the intervention with the influence of secondary school teaching in the same subjects (Lee, 2005). An empirical analysis of Grade 11 school grades of the students, relative to their grade 10 individual subject baseline, was selected as the most feasible given the resources available. This analysis objectively evaluated any grade difference at different levels of granularity: overall, grades as per subject, grades as per subject per particular term. Because the core skills workshop focused on personal improvement strategies, which are difficult to measure objectively, an interview approach of the students was used to gather their perceptions on the effectiveness of the programme in improving their life skills.

Pilot Survey of Student Perceptions of Programme’s Effectiveness

At the beginning of 2013, the programme sponsors conducted a pilot survey of these students in order to measure certain aspects of the effectiveness of the programme. The survey was designed by the programme coordinators and it was composed of ten themed quantitative, close-ended, and
Likert scaled questions and several open-ended questions that allowed comments. The themes of the survey focused on the value of the session, the venue, and the helpfulness of the peer mentor. The questionnaire was distributed to all of the students during one of their Saturday class sessions and collected once completed that day. The results were then analysed using frequency analysis of the close-ended, Likert scale questions with the responses to open-ended questions added as supplementary results. A few of the questions with their results are given in Table 1.

### Table 1. Some results of pilot survey (Ally, Millham, Thakur, & Malan, 2013)

<table>
<thead>
<tr>
<th>Question</th>
<th>Always (%)</th>
<th>Mostly (%)</th>
<th>Sometimes (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>The venue was well organised</td>
<td>92</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>The facilitator gave assistance when needed</td>
<td>58</td>
<td>25</td>
<td>8</td>
</tr>
<tr>
<td>The facilitator seemed sensitive to and concerned about student Progress</td>
<td>54</td>
<td>38</td>
<td>8</td>
</tr>
<tr>
<td>The session was of value</td>
<td>33</td>
<td>33</td>
<td>25</td>
</tr>
</tbody>
</table>

Some student comments include a desire to take their laptop, which is available to them only during the intervention session, home to catch up on exercises and to wear T-shirts rather than school uniforms (Ally, Millham, Thakur, & Malan, 2013).

**Student Perceptions of Self-Regulated Learning**

Given the inconclusiveness of the results of this pilot survey and the wide deviation of the grades, our research team decided that these results warranted a more comprehensive investigation. This investigation would further explore, in terms of focus group interview questions, the components of the programme with themes including their perceptions on the eLearning system’s software, content, structure, assessments, and educational benefits and on the facilities with suggestions for improvement (Ally, Millham, Thakur, & Malan, 2013). Part of this investigation, in the form of interview questions, was modeled on Sun, Tsai, and Finger’s (2008) thirteen factors of eLearning satisfaction described above.

These themes, with their sub-themes, included:

1. Programme
   1.1. Administration and Management
   1.2. Learning Environment
       1.2.1. Facilities
       1.2.2. Technology
   1.3. Learning Resources
       1.3.1. Content
       1.3.2. Assessment
       1.3.3. Activities
       1.3.4. Feedback
   1.4. Delivery Platform
       1.4.1. Flexibility
       1.4.2. Customization
   1.5. Social
       1.5.1. Peer-to-peer interaction and engagement
       1.5.2. Enjoyment
   1.3.5. Tasks
   1.3.6. Resources

Two researchers developed a set of open-ended questions and sub-questions, based on the themes above, which would investigate these matters more in-depth. During the last session of the school year, each student in the programme received a paper which listed these questions and provided space for their responses. As the questions were read out by the researchers, students were encouraged to come forward to a central microphone, which recorded their replies, to provide their own individual responses and perspectives to the question asked. If the students were unwilling to come forward, they could respond to the question by writing their individual responses to the
question on the paper provided. At the end of the session, all of the papers were collected. The individual answers, on paper along with the recorded speech, were transcribed. A coding scheme, partially based on the themes above and on the variety of responses, is still being developed. The responses will be coded and analyzed using the qualitative research tool, NVivo. The full set of results is still not available.

**Grade Analysis of Self-Regulated Learning**

To complement this focus study, an examination of the assessment results was performed. Our approach is a comparative analysis, by term and grade range, of secondary school grades achieved by the students enrolled in the programme before, during, and after the eLearning intervention programme. This analysis was motivated by several previous efforts. As the schools chose the best three students from their school, comparison of grades achieved by this group with a similar control group was difficult; consequently, it was decided to compare their subsequent secondary school grades in these subjects, on a term basis, throughout their Grade 11 year with their final Grade 10 grades, just before they entered the programme, as a baseline comparison in order to determine the effectiveness of the eLearning intervention.

As required by this programme, each school that a student attended was required to send their final grade 10 marks in English, Science, and Mathematics before admission into the programme and then submit these same subject marks, at the end of each term, to the programme coordinator throughout their Grade 11 year. The anonymized marks were used by the researcher, in their comparative analysis, to determine the effectiveness of the programme in terms of grade improvement.

Our approach measures the secondary school grades, categorized by grade groups A-F, by terms (South African half semesters). Grade grouping was performed to make analysis of marks easier. Average scores and standard deviation for each subject per term is used to ensure that grade grouping did not obscure results. Descriptive statistics was used to measure grade improvement of the program students relative to their Grade 10 grade baseline. Twenty-six students completed the program with available grades.

Our results were hampered by a number of factors:

- The number of students who attended these sessions and who reported their school marks varied from term to term, which may have skewed the results.
- A number of students (approximately 6) attended the program throughout the year but after writing their final exams in December, their grades were still not submitted to the program coordinator so their results could not be analyzed. In addition, not all grades for the previous terms of all students were submitted so data for different subjects in terms is not available. Better data collection procedures need to be implemented and enforced.
- As the preliminary results of our focus interview revealed, a number of students suffered from Internet outages, laptop problems, and login issues which prevented them from utilizing the eLearning facilities.
- Some of the students indicated, in our focus group interview, that they never used laptops before so it took some time for them to adjust and readjust to use them [10]. An example, only eight of the students in the programme had some basic prior computer usage, with just one student having an email account.
- The length of travel also likely played a role. A number of students had to travel three hours each way to reach the university for a six hour tutorial. Often, after they arrived from their long journey, they would find that due to Internet outage or laptop problems, the tutorial was no longer viable and they had to travel the three hours back with no learning gained (Ally, Millham, Thakur, & Malan, 2013).
Core Skills Workshop

In order to evaluate the effectiveness of the 5 day core skill workshops, students of this workshop were interviewed individually at the end of the workshop in order to determine the effectiveness of the programme as well as how the programme could be improved. The workshop coordinators developed a list of open-ended questions which workshop students were encouraged to answer. Each willing student was interviewed using this list of questions and their responses were recorded. The students’ individual responses were categorized and then compared to determine if at least the majority of students found these workshops helpful.

Results

Focus Group Results

Some of the comments of the students who participated in the programme are included below.

Improvement

“I have improved on my marks (math, English, science) and overall confidence and I was not getting more than 60% but now I’m getting over 65% to 70% because of this programme and I’m looking forward to get 80% at the end of the year.”

“The programme benefitted me in a way that helped me understand my mistakes and also helped in understanding some contents of the work that were a bit difficult by continuously doing assessments until I understood the work.”

“My marks I received in the first term was not very good, but with the help of this programme I managed to get excellent results I believe I can improve if I can get a little help”

E Learning

“This programme made me love physics which was the subject I hated most because I thought it was hard”

“Some online videos assisted me because there were some chapters of physics that I didn’t hear well in school but watching the videos assisted me”

“There are videos, online help, and tutor to help me understand better”

“Online tutor is there and it very helpful”

“It was very simple to use”

“Time was not allocated but was monitored which made it less pressuring as we could work at our own comfortable pace”

“no not the same because in school we are writing with a pen but here we are just typing on the computer and here you get your result of a done work, the moment you submit each and every question”

“Doing the activities over the internet was interesting because you do an exercise and it got marked in the same time and there is a graph showing your progress”

“About the assessment it was good to do it because when use finish those assessments they ask you to do you will be provided but given you feedback

- And when you have feedback you see where were you wrong
And I can say it easy to follow it because you should know what are you really suppose to do”

Programme
“This is a good programme and my friend can join it. They pay our fees, including transport and food. We learn many things using e-learning which makes it easy.”
“here, the programme is useful and helpful you gain many things by practice and you increase your knowledge and you get correction of your work.”
“I can tell anyone that it is an honor to come”
“The environment was great except the noise from the stadium”

Student background
“The fact that I come from a poor background being given this opportunity to change it motivated me to work harder towards a better life for me and my family, it’s a once in a lifetime opportunity and I am thankful to be chosen to embark on this journey”
“We use laptops which is unusual for the place where I am living. I do not want to lose this kind of opportunity!”
“I was satisfied though wearing a uniform even on weekends was a bit tricky and also the money problem was challenging situation because my mother sometimes has to borrow some money in order for me to come here because she’s jobless”

Challenges
“I spend a lot of time with computers therefore the eLearning system was easy for me to use, but with many other students they had to learn how to use the laptops in the first place”
“our laptop were having network problem”
“The technical support was okay, but during the first two terms we had power problems and during the second last two terms we had power problem with connectivity which really set us back in our work”
“The computer facilities was having a problem on network and battery and the charges”
“The network problems were running on and off”
“We started late on the second term and we had to pick up the most important topics”
“The campus is well mannered but it is too far away from my home so I have to travel and take taxis 3 times before I get here so get here late. And I leave my home at about 6 o’clock in the morning to cover 9 o’clock here.”

Students’ recommendations
“Some lessons I learnt is that I need to pull up my socks to get some good results.”
“Some of us are able to access the Internet outside of the campus and it would have been better if we were able to take the laptops and use it in our own time or spare time to better our learning.”
(Ally, Millham, Thakur, & Malan, 2013).
This feedback indicates that the programme was successful in improving students’ grades in secondary school and in providing effective feedback that enabled the students to learn from their mistakes. The comments also indicate that many students were unfamiliar with how to use a
computer (and the subsequent eLearning systems), the eLearning systems suffered from network connectivity issues (which was vital for their operation), and that some students had to spend three hours one-way commuting to the venue.

Grade Analysis Results

Our results indicate that the intervention did play a significant role in improving student marks.

Table 2: Average and Standard Deviation (Millham, Thakur, & Malan, 2014)

<table>
<thead>
<tr>
<th></th>
<th>10-T1</th>
<th>11-T1</th>
<th>11-T2</th>
<th>11-T3</th>
<th>11-T4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Avg Subj</td>
<td>60%</td>
<td>57%</td>
<td>52%</td>
<td>64%</td>
<td>65%</td>
</tr>
<tr>
<td>Std Dev</td>
<td>0.13</td>
<td>0.16</td>
<td>0.14</td>
<td>0.16</td>
<td>0.15</td>
</tr>
</tbody>
</table>

As seen in Table 2, the subject grades for all present students in the subjects of physics, mathematics, and science are averaged in order to determine grade improvement along with a calculation of standard deviation in order to determine improvement variance amongst this group of students. There is a rise in the average subject grade from 58% in Grade 10 to 65% at the end of Grade 11 with a subsequent slight increase in the standard deviation from Grade 10 to the final term of Grade 11. These figures suggest that the majority of students did benefit to some extent by this program but some students did better than others (Millham, Thakur, & Malan, 2014).

Figure 1: Distribution of Grades (Millham, Thakur, & Malan, 2014)

Figure 1 details the number of students achieving a grade group by subject per term. In regards to the Grade 10 base of an average of Ds in math and physics with a C in English, this program details, in Figure 1, a steady improvement in these subjects’ marks throughout the third term. The dip in marks during Term 2 could be attributed from the sudden change in South African math and physics curriculum from OBE (Outcome-Based Education) to CAPS which created a lot of confusion and difficulty for secondary school students, in the second term of Grade 11, which shows high failure rates in mathematics and physics. One subject that shows the most grade improvement throughout all of the terms was English. Although the reason for improvement in this particular subject warrants further investigation, one possible reason is that the tutorial material was all in English and the students, most for whom English is a second language, would have
been forced to learn additional English incidentally in order to progress through the program (Millham, Thakur, & Malan, 2014).

Table 3: student numbers by grade (GR) by term (T) (Millham, 2014)

<table>
<thead>
<tr>
<th>Gr</th>
<th>Gr10-T4</th>
<th>Gr11-T3</th>
<th>Gr11-T4</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>2</td>
<td>3</td>
<td>6</td>
</tr>
<tr>
<td>B</td>
<td>5</td>
<td>2</td>
<td>9</td>
</tr>
<tr>
<td>C</td>
<td>6</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>D</td>
<td>8</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>F</td>
<td>4</td>
<td>1</td>
<td>5</td>
</tr>
</tbody>
</table>

As indicated in Table 3, when you look at the number of students achieving an A or B grade, the number increased 31% from Grade 10 to 11 (final term). The number of students achieving a C dropped by 12% and the number of students who achieved a D dropped by 19%. The number of students that failed dropped by 1 person or less than 1% (Millham, Thakur, & Malan, 2014).

Any analysis of student performance in this program must consider the lack of complete marks for all students who completed the programme which makes a full and detailed analysis of their grade performance difficult. This program, viewed in light of secondary school scores of students who stayed throughout the program, suggests that the number of students that achieved higher grades of A and B, relative to their Grade 10 grades, was significantly increased. In addition, the number of students achieving an average grade of C or D seems to have decreased quite significantly. The number of failure grades remained roughly the same (Milham, 2014).

The provision of this eLearning program seems to have been effective to high-potential students, who were scoring below their potential and who were given learning resources that were unavailable to them before. It also appears to be quite effective for borderline students who seem to have improved their mark significantly (Millham, 2014).

Core Skills Workshop Results

Interviews with workshop students indicated that these workshops were highly effective and enabled the students to acquire the skills outlined in the workshop. However, some of the students wished that the workshop have a deeper investigation of issues surrounding one’s self such as self-awareness, identity, self-awareness, self-esteem, and confidence. Other advice included beginning this workshop with Grade 11 students, rather than Grade 12, and follow a building block approach in their learning method.

Recommendations

Student Perceptions of ELearning Intervention

Some recommendations, based on our findings from the focus group interview, are as follows:

- Develop and promote an online discussion forum to facilitate discussion and collaboration
- Conduct regular sessions on self-regulated learning
- Ensure consistency in curriculum between online material and offline teaching
- Implement learning analytics strategies
- Identify and address difficulties, progress, participation rates of students
- No explicit intervention from outside the system
- Take home devices (implemented for 2014)
• Headphones for students to listen to videos without disturbing others
• Possibly different venue: noise from stadium
• Address network outages
• Survey students on food preferences
• In addition, the following needs to be explained at beginning and clearly reinforced:
  o The concept and objectives of eLearning
  o Role of tutor and coordinator
  o Goals and purposes of programme

As those students who achieved an A or B combined average in the subjects of mathematics, English, and physics will continue on with the program in Gr 12 and a new group of students from Gr 11 have begun this program this year, opportunities are presented for both a longitudinal study of the original group as to their secondary school performance (with their matriculation results) and their perceptions of the program, as it changes in response to problems encountered earlier on (lack of wireless in many instances). In addition, the new group provides fresh opportunities to determine their degree of improvement with the newly-adapted program.

**Core Skills Workshop**

Some of the recommendations for this workshop include:

Have the mentors of these students, who may be part of another programme with these students, attend these workshops to ensure that these core skills are taken forward

Use these workshops to further develop the relationship between students and their mentors

Run these workshops over the December holidays for Grade 11’s and run a refresher course for Grade 12’s at the same time. Thus, any school-workshop clash should not occur.

**Future Directions**

This project, due to its lengthy continuous nature, offers the possibility of a longitudinal case study of students and determining changes in student perceptions of the e-Learning programme and core skills workshop and in grade changes over a period of time. As the first students enter matriculation year, it can be determined if their grades continue to improve and what percentage of them qualify for university admission and of this percentage, what percentage would attend university. Several recommendations for improvement are given for both the eLearning programme and core skills workshop; it would be interesting to note the effect on students, measured using the same original methods, as some or all of these recommendations are implemented.

In the wider sphere, this programme and workshop could be rolled out to a wider audience of students across South Africa. This intervention would hopefully help, even in part, to address some of the problems of overcrowding, lack of resources, and lack of individual attention that these students encounter.

**Acknowledgements**

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**References**

Evaluating the Effectiveness of Elearning and Core Skills Interventions


**Biographies**

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**Colin (Surendra) Thakur** is Director at the KZN e-Skills CoLab which is tasked with e-skills education in general, and particularly on the e-enablement of government services for effective service delivery. He conceptualized and introduced InvoTech, an innovation incubator at DUT. Colin Thakur was the Chairman, Vice-Chair and National Treasurer for the years in worked with the KZN Computer Society of South Africa. He served on the Inaugural Complaints and Compliance Committee (CCC) of ICASA. Colin was commissioned by the IEC to undertake an international study of electronic voting (e-voting) practices completed in 2012 called “Electronic Voting – the cross-national experience.” Colin delivered 6 key notes on this topic, wrote five papers and was an international observer in the Zambian election. He will observe two e-voting elections.
Key Success Factors for Developing e-Skills in a Developing Country: South African Case Study

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Abstract

The establishment and development of the Internet and other Information and Communication Technologies (ICT) in recent decades, enabled by increasing capacity, mobility, accessibility affordability and “vision based” applications of ICT, represent the material foundation for the networked society. This is often referred to as “Information Society” and/or “Knowledge Economies”. However, the creation of such a technology-supported society that holds the promise of being increasingly self-reliant and equitable, involves fundamentally new ways of thinking, working and living. It requires the building of new capacities, particularly those related to the effective appropriation of ICT, not only in the work force but across the dynamic of the entire population and specifically including the low socio-economic groups. These capacities have often been referred to as “e-skills”, “e-literacy” or “e-competences”. They are deemed as indispensable in addressing important social issues such as poverty and unemployment, the safety of citizens and in building an inclusive and capable developmental state. Recent research in South Africa confirms that building these skills and competencies in the context of a developing country (and the developmental state) require careful planning and execution. Crucially it depends on inter alia: (i) a systemic, multi-stakeholder, collaborative and aggregated approach, (ii) the creation of an influential and credible e-skills ecosystem, (iii) the development of an appropriate e-skills taxonomy, (iv) the astute use of ICT and e-skills/e-competences (e-Astuteness and e-Social Astuteness) and (v) meaningfully supporting national socio-economic developmental strategies and agendas. It is envisaged that this report will benefit practitioners (principally government planners) in developing, particularly African, countries as well as researchers willing to advance this work.

Keywords: Knowledge Society, ICT, e-Skills, e-Competences, Critical Success Factors, Developing Country, Africa.
Introduction

The rapid pace of development and institutionalising of modern information and communication technologies (ICT) across society in recent decades is by many seen as a technological foundation for advancement of so called Information Society and Knowledge economies. This development, which variously affects corporate sector, public organisations and entire societies, demands new set of skills associated with fundamentally new ways of thinking, working and living in this technology supported and networked world. Hence, it is not surprising that the skills and competences required by such a society are often concomitant with the use of modern ICT devices and programmes and are often referred to as e-skills or e-competences (EESF, 2004; NeSPA 2010; SFIA, 2012). In general, these skills and competences involve the ability to develop and use ICT to successfully participate in an ICT supported networked environment dominated by access to digitally enabled information coupled with an ability to synthesize available information into effective and relevant knowledge.

However, it seems that very fast technological development creates e-skills capacity shortages in both developing and developed worlds. For example, it is reported that Europe’s growing e-skills shortage is affecting the productivity and the competitiveness of large and small organizations across society (eSEW, 2010; eSN, 2010). The situation in South Africa is not much better, causing South Africa (SA) to slip down the international ‘e-readiness’ rankings - it is estimated that South Africa continually experiences a shortage of over 70,000 IT professionals (ITWeb, 2008). As reported recently, the shortage of e-skills is even more perturbing since the supply of ICT graduates in many countries is now showing a decline (Birchwood Declaration, 2007; Accenture, 2008; NeSPA, 2013). In short, , many African and other developing countries are experiencing a very short supply of people possessing required e-skills capacity - be it for either equitable prosperity opportunities within a country or global competitiveness of their economies.

One of the main challenges that developing countries face in skilling their citizens for equal prosperity and global competitiveness lies in fact that obtaining appropriate e-skills is not a once-off event since fast paced technological changes require continuous upgrade of these skills. Despite the fact that some developed countries (e.g., UK, EU states) are successfully addressing e-skills agenda, it is apparent from many interventions that the solutions for these countries cannot be easily replicated in the developing world. For example, ICT skills and competences related frameworks such as the UK Skills for Information Age (SFIA, 2012) or the European Union (EU) European e-Competency Framework (EeCF, 2013) largely revolve around so called “practitioners” (or professional) e-skills and e-competences. Unlike developing world, these countries do not have the urgent need to address, huge social and economic disparities, massive illiteracy, or considerable ‘digital divide’, which become apparent through inequitable access to and ineffective use of the contemporary ICT. Thus, overcoming these serious problems requires a different, significantly proactive and innovative effort as large portions of the population in developing countries will require effective e-skills for sustainable socio-economic growth and development.

In the context of the developmental state, which implies a wider involvement of government, our study is based on the premises that: (i) the United Nations (UN, 2005) call for “socially inclusive governance for the information society”. This includes a new paradigm focused on human development and socially and digitally inclusive developmental strategies, that involves an inclusive mode of governance where all citizens of a will have equal access developmental opportunities and (ii) one of the key challenges in effecting e-government identified in developing countries is the low level of ICT literacy and skills amongst the potential users of e-government approaches (Khan et al., 2010). In the same manner, Sahraoui (2007) suggests that the effective adoption of e-government is not possible without digital inclusion (e-inclusion). It is self-evident that neither e-inclusion nor e-government would be possible without e-skilled and e-competent people.
This paper outlines a case study from South Africa that can also be relevant to other African or other developing countries worldwide. Using the case study methodology (Le Compte & Preissle, 1993, p. 39), we apply a “thick description” (Merriam, 1991, p. 11) to describe a systemic and systematic approach to e-skilling in South Africa by answering the questions: (i) why an e-skilling agenda in South Africa was needed, (ii) what approach was used to address this agenda and (iii) what were the key success factors for this endeavour.

The South African approach to e-skilling is thus far unparalleled, so it was not possible to find comparable examples from other countries reported in the modern literature. Thus, this paper is based on more than three years of experience with a national approach to e-skilling in South Africa. We believe that this report has relevance for academics, practitioners and policy-makers in the field of e-skills delivery. The approach described here has particularly relevance for developing countries and will add to the reported literature and thereby provide input for a collective approach to advance research and practice in this arena.

This paper now proceeds with the background to the approach to e-skills development in South Africa and is followed by a description of that approach with the focus on the key success factors. The article ends with a conclusion section that outlines the main points of this study, limitations and suggestions for further research.

**Background**

The establishment of the e-skills agenda in the developmental state of South Africa was based on a number of suppositions including the recognised importance of ICT for building Information Society and Knowledge Economy for a more equitable prosperity and global competitiveness, the fact that the country has considerable shortage of e-skilled (an e-astute) people, the recognised need for these kinds of skills to address the country’s major socio-economic issues and the country’s dramatically declining position in the global e-readiness rankings (GITR, 2013; NeSPA, 2010, 2013). In order to tackle these problems, the SA government has thus far taken a number of actions such as establishing an e-skills institute (now launched as the iKamva National e-Skills Institute - iNeSI), organizing two national e-skills summits in 2010 and 2013 and in developing two national e-skills Plans of Action (NeSPA, 2010, 2013).

The primary focus of iNeSI was (and still is) to be a catalytic leader, coordinator and aggregator of effort in order to engage a wide base of various stakeholders to develop a collaborative and integrated national policy, which would guide further action in e-skilling the nation for more equitable prosperity and global competitiveness. In that regard the iNeSI collaborates with all government departments on the national level as well as with businesses, education, civil society and organised labour.

The First e-Skills Summit (Cape Town, June 2010) which brought together more than 300 local and international delegates, concluded that the e-skilling in South Africa could not be successful within the old paradigm involving only input (e.g., required resources) and output (e.g., number of e-skilled people). Hence, the delegates recognised that ‘copy’ from other countries (particularly developed) and ‘paste’ to South Africa (or other developing countries) was not an effective approach. The Summit discussions recognised that a new paradigm, which requires a shift in emphasis from ‘inputs and outputs’ to impact was needed. An approach using ‘collaborative network architecture’ through a coordinated effort to shift past ‘doing to’ and/or ‘doing for’ towards ‘doing with’ was needed at the local level. This required the use of existing resources across all stakeholders as well as individual stakeholder inputs and rights. It was believed that this approach could bridge the operational and structural gaps between the stakeholder groups (business, gov-
ernment, education, civil society, organized labour) at local, provincial, national and international levels, thereby providing a sustainable national structure (Mitrovic at al., 2012).

The Second e-Skills Summit (Cape Town, October 2012), jointly held by the iNeSI and the International Telecommunication Union’s (ITU) Global ICT Forum on Human Capital Development concluded that that a major e-skilling agenda in South Africa should make a ‘profound difference’ in people’s lives by addressing poverty, developing an active citizenry that was capable of contributing to ‘people centred development’ and establishing a capable and developmental state. It was also concluded that so called ‘core’ e-skilling (i.e., skilling people for using hardware, software and networks), although necessary, was not sufficient to address triple crisis of poverty, unemployment and inequality. The delegates also concluded that the rate of ICT evolution was often outstripping the capacity of Government, Education and Business to adequately equip society within nation states; hence a multi-stakeholders approach was necessary for an effective e-skilling in the developing countries (ITU-Summit, 2012). Both e-Skills Summits resulted in the development of National e-Skills Plans of Action (NeSPA, 2010, 2013). These stressed the point that the multi-stakeholder collaborative approach and linking e-skills agenda to the national development strategies and plans was the key to successful skilling the nation for equitable opportunities and global competitiveness (NeSPA, 2010).

These plans provided clear directions for actions at national, provincial and local community levels. However, these high level key success factors were not sufficient by themselves to explain all of the important concepts that were required for e-skills success in the context of developing country. Hence, the next section, in portrays the elements that appeared to be key success factors for effective e-skilling in the context of a developmental agenda.

**E-Skilling Success Factors**

**E-Skills Definition and NeSPA Taxonomy**

Firstly, the iNeSI definition of e-skills was based on the WSIS (2003) and European e-skills Forum (EESF, 2004) and refers to the ability to develop and use ICTs within the context of a knowledge environment and associated competencies that enable the individual to participate in a world in which ICT is a requirement for advancement in business, government and civil society (Wesso, 2008). Initially, the e-Skills Institute adopted a taxonomy that described four types of e-skills:

- **ICT practitioner skills**: the capabilities required for researching, developing, designing, managing, producing, consulting, marketing, selling, integrating, installing, administrating, maintaining, supporting and servicing ICT systems.
- **ICT user skills**: the capabilities required for the effective application of ICT systems and devices by the individual.
- **e-Business skills**: the capabilities needed to exploit opportunities provided by ICT - to explore possibilities for new ways of conducting business and organizational processes, and to establish new businesses.
- **e-Literacy**: the capabilities needed to socially appropriate ICT for local development (Wesso, 2008).

However, the First e-Skills Summit (2010) delegates believed that this taxonomy was limiting in a South African context. Following an extensive discussion in the dedicated working groups and subsequent plenary debate, a new e-skills classification was suggested as follows:
• **e-Literacy Skills**: aimed at employment readiness, particularly targeting unemployed and unskilled youth and rural society (including starting own small business);

• **e-Participation and e-Democracy Skills**: focusing on enhancing citizen interactive engagement with communities, local, provincial and national governance processes to increase participation, self-reliance and equity;

• **e-Government/Governance Skills**: focusing on increasing efficiency and productivity interactive bimodal approaches to service delivery of governments and its agencies across all ICT platforms including new cell phone technology, community radio, and the like;

• **e-Business Skills**: aimed at increasing organizational efficiency and productivity;

• **e-User Skills**: focusing on enhancing the efficiency of public and private sector knowledge workers;

• **e-Practitioner Skills**: aimed at enhancing the capacity of public and private sectors to manage, support and service ICT; and

• **e-Community Skills**: aimed at increasing self-reliance, participation and community support in a socio-economic setting to build social cohesion in ways that can better build local solutions to societal matters such as crime, health, education and the like (NeSPA, 2010).

**Key Success Factors for Delivering the e-Skills Agenda**

Achieving e-skills goals, as defined in NeSPA (2010) was not an isolated process but was tightly linked to the peak national development policies, such as the Medium Term Strategic Framework (MTSF) 2009-14, National Development Plan (NDP), or internationally accepted obligations, such as the attainment of Millennium Development Goals (MDGs) and the World Summit on the Information Society (WSIS) plan of action. Bearing the requirements in mind, the Summit delegates identified nine key issues for the development of an e-skills action agenda for South Africa. These issues were considered as the key success factors in e-skilling:

• Affordable access to ICT;

• Collaborative approach across existing effort and gaps to action the e-Skills agenda;

• Action within ‘A Path to Impact’ based approach to enhance the delivery of established policies and programs and build new approaches;

• Cooperative network architecture based on nodes at local level;

• The need for a comprehensive research program that will inform policy development, practice, service delivery and (lifelong) education;

• Focus needs to include support for small, micro, and medium enterprises (SMMEs)

• Focus on the national development programmes and agendas;

• Effective use of existing resources;

• Starting the delivery of NeSPA with a few overarching projects.

**Affordable access to ICT**

In South Africa, there is recognition that access to affordable and effective ICT is a basic human right. It is believed that, alongside access to water, electricity, transport, food security and right to work, the lack of access to these technologies will rapidly increase inequity (thus negatively im-
impact on social cohesion), reduce effective health care, increase crime, and reduce life opportunities, particularly for the people in poor communities. This affordable access to ICT for all citizens is also a key prerequisite for the sustainable development of e-skills in South Africa. The ubiquitous access to ICT is also seen as the contributing factor towards achieving National Equity Goals (reducing impact of class, race, gender, age, disability, and HIV/AIDS) set out in the National Skills Development Strategy 2011/12 – 2015/16 (NSDS, 2010). As pointed out by the delegates at the e-Skills Summit and stated in NeSPA (2010), delivering equitable access to both ICT and technology based services through a transfer pricing mechanism such as already applies to water and electricity should bring a compelling value proposition, through increased applicability and affordable cost, to all South African people (Mitrovic et al, 2012).

Collaborative approach, “path to impact”, and cooperative network architecture

According to Taylor (2004), the collaborative approach starts with developing a base for a collaborative model across government, business and education which in turn provides the basis for policy development, collaborative research across the broad base of e-skills, and promoting public discourse around such matters. This collaborative approach focused on practical, applied, policy relevant research was likely to have a greater impact on policy and practice through supporting coordinated bodies of work, rather than a scatter of atomised, free-standing projects. It will also provide the base for managing risk of (unproductive) dominance of one the involved sectors (business, government or education) over a broad societally relevant agenda of e-skills development.

The main idea behind new, collaborative model for addressing e-skills shortage in South Africa is to overcome the ‘silo’ approach of government departments, education, business and civil society by harnessing existing and developing knowledge and skills evidently available in educational institutions, corporate businesses, and across the government – not just in South Africa but also internationally. The main purpose of this collaborative model was being to effectively support the processes of e-skilling the nation for the Information Society and creative knowledge economies. These processes would be facilitated by the South African government through than e-Skills Institute (e-SI), now re-launched as iKamva National e-Skills Institute (iNeSI). This collaborative initiative was developed in order to support activities of the institute in the following way (Mitrovic, 2009):

- To establish an independent governance structure, e-skills agenda & delivery capability;
- To achieve its key political and policy imperative of delivering to the country sufficient e-skilled workers (10,000 skilled workers in a immediate future);
- To assist e-SI to obtain national and internationally recognised stature and build further impact;
- To assist in securing a strategic output (research and development) implemented at low cost but high impact that informs three key areas: (i) the capacity of the network, (ii) the capability of the network to deliver network driven e-skills development, and (iii) a medium to long-term analysis of the targets and achievements of the e-SI.

In this regard, the proposed collaborative model needed to be capable of establishing national and international collaborative networks of a diverse stakeholders (e.g., universities, corporate and government based researchers and policy-makers) committed to contributing independent intellectual capital and policy advice on options for implementation and evaluation of e-skills strategies to the e-SI and other stakeholder groups.
On the other hand, involving citizens in the e-skills collaborative agenda helps faster ‘buy-in’ by potential beneficiaries, decentralisation of e-skills policies and greater citizen participation in the government affairs – regarding preparation the citizenry for the Information Society and Knowledge economies. This policy decentralisation was not new to Africa as, for example, Ghana used such a decentralised approach for government and its services from 1988. As Misurac (2007) points out, an important aspect of the implementation of decentralised policies for government emphasised the specific role given to civil society organisations, the private sector, as well as traditional authorities, to collaborate in the development of partnership and participate in decentralised multi-partnership efforts.

The values of the collaborative efforts aimed at the capacity building (e-skills in this case) are now well recognised not only in South Africa but in other African countries and-Pan-African organisations. For example, the government of the Republic of Uganda recognised the important role of ICT and developing e-skills for national development through its ICT Policy framework (2002) that strongly advises “enhancing collaboration and co-ordination in ICTs development at the local, regional and international level” (UICT, 2003). Furthermore, it is recognised that the effectiveness of the African Information Society Initiative (AISI) depends upon successful skills development, i.e. capacity building and the identification of potential areas for collaboration among stakeholders (ECA, 2008).

The South African e-skills collaborative approach is depicted in Figure 1. This approach involves stakeholder collaboration (across government, business, education and civil society) apply research results within appropriate collaborative network architecture. It is believed that this approach can secure not only output and outcome but wider societal impact in South Africa (NeSPA, 2010).

**Path of Impact**

![Diagram of Path to e-Skills Impact](Source: NeSPA, 2010)

Despite the aspirations of a number of recent national efforts to address collective national problems through existing delivery channels at national level, the fact remains that, in the absence of a collaborative network architecture that can legitimize development, impact achievement has been less than expected. Since, as deemed by the e-Skills Summit 2010 delegates, socio-economic impact is primarily local and then national, addressing the profound issues that South Africa faces, an appropriate developmental dynamic can only be found in changing the prevailing paradigm:
from “doing to” and “doing for” to “doing with”. Such an approach is depicted diagrammatically in Figure 2.

**The New Way,...Doing with**

![Diagram](image)

**Figure 2: “Doing With”** (Source: NeSPA, 2010)

**Comprehensive research programme**

Since a large number of e-skills research initiatives were in progress across a range of agencies in Government, Business, Education and Civil Society in South Africa in 2010, it was recognised that a process to group these into aligned activities was required to examine possible overlap and to identify gaps. It was suggested that future e-skills related efforts (delivery and research) needed to be categorised into theme areas that could allow appropriate assessment of needs, determine relevance to the national e-skills agenda and the goals of the appropriate strategic plans (e.g. MTSF, NDP etc.), identify the relevant discipline bases that could support them and to determine the specific needs of key stakeholder groups. The delegates of the First e-Skills Summit (2010) agreed that the starting point for this should include the following themes: (i) benchmarking and progress of the current e-skills situation in South Africa, (ii) state of the infrastructure and access to ICT and e-skills, including convergence, new models of access for underserved communities, (iii) ICT and e-skills in education, including the alignment of current and future pedagogy, (iv) ICT and e-skills in business, including both synchronous and asynchronous use of converging technologies in bimodal service delivery and (v) ICT and e-skills in the community context, including the use of social media in meeting the needs of the population (NeSPA, 2010).

Due to the particular socio-economic situation of South Africa (a mixed mode economy which is reflective of the needs of many developmental states), programme delivery and research in the e-Skills arena is a complex endeavour. Hence, it should encompass a multi-factored approach that recognises the dimensions of a developmental state and their interactions with a rapidly evolving set of converging technologies.

At the same time, it was realised that in South Africa that these emerging technologies especially cell phone adoption, have already demonstrated rapid uptake in low socio-economic collectives that have very poorly developed capacities to appropriate these technologies to improve individuals life chances and deliver more equitable outcomes at the community level. This prompted the
national e-skills institute to propose prioritising the following areas for e-skills research: (i) more equitable access model to ICT infrastructure, (ii) compare e-skilling needs of the served communities i.e. potential demand with the e-skills supply in order to identify a ‘skills gap’, (iii) e-skills curriculum development, and (iv) alignment of e-skills initiative with the national development strategies and agendas. It was also proposed that the e-skills related research should involve all relevant multi-disciplinary stakeholders including inter alia academia, social scientists, educationalists, business, civil society, labour, donor agencies and countries and all three spheres (national, provincial and local), branches and departments of government.

An assessment of e-skills research was delegated to the South African Research Network for e-Skills (ResNeS), which was established in 2011. This body has established the criteria for measuring effectiveness of e-skills research, i.e. the key success factors related to the impact of the e-skills related research in terms of the objectives of the national e-skills agenda, which is articulated in two national e-skills plans of action (NeSPA, 2010, 2013). These factors include (i) measurable and specific targets/milestones, (ii) inclusivity in the e-skills policy development processes, (iii) monitoring (audit) the number of people being skilled (in the government, business, education and civil society as well as the ICT sector), (iv) the effectiveness of training programmes, which includes the ‘Training the Trainers’ programmes, the growth in jobs, the effectiveness of service delivery, the competitiveness of business sectors, the impact on social cohesion and the changes in attitude of being skilled, (v) an annual audit on key ICT statistics, (vi) online availability of education curriculum, (vii) tracking the movement of ICT professionals, key service delivery professionals and educators/trainers across the sectors and the associated migrant flow in and out of the country, and (viii) set and validate e-skills standards, which will help in achieving an international recognition of offered qualifications.

Focus on SMMEs and the national developmental agendas

In many countries, small, medium and micro enterprises (SMMEs) are regarded as ‘engines of growth’. In South Africa there are about 2.5 million SMMEs, including many in the informal sector. These enterprises constitute up to 95% of South African businesses. Further, it is estimated that this sector has doubled in size over the since the early 2000’s, growing at about 7% annually (Branam, 2008) and that SMMEs account for 99.3% of all privately owned enterprise in South Africa (DTPS, 2014). Hence, the sector’s current and potential contribution to economic growth and employment places a very high significance on e-skills capacity development for SMME sustainability and growth has (Mitrovic et al., 2012).

There are numerous studies which suggest there are significant opportunities to increase SMME efficiency by leveraging ICT. However, there are also challenges faced by SMMEs in South Africa and Africa that affect the capacity of SMMEs to obtain substantial benefit from appropriating modern ICT devices and applications and these need to be addressed. These challenges inter alia include (i) high cost of Internet access (particularly in previously disadvantaged and rural areas), (ii) lack of integration and coordination of support for small business, (iii) variable service delivery quality, which lowers ability to compete with larger enterprises, (iv) late payment patterns by government, increasing financial pressure, and (v) traditional challenges with monitoring and evaluating SMME sector.

As many of these problems can be addressed by effective appropriation and use of modern ICT devices and applications, the immediate task for e-skills capacity development in the SMME sector is to significantly increase the limited ICT literacy (e-literacy) and e-astuteness across the country. Increasing the general level of e-literacy within SMMEs can increase efficiency and profitability, whilst increasing the general level of e-literacy and e-astuteness amongst youth, disadvantaged and rural communities will lead to more micro-enterprise development and opportu-
nities to develop a more collaborative and integrated mind-set. This is essential to attract appropriate investment, build an increasing self-reliance and embed innovation and responsiveness (NeSPA, 2010).

The e-skills capacity development in the SMME sector (and also entire population for Information Society) cannot happen in isolation – it needs to be approached within the context of building an inclusive developmental economy in South Africa and similar developing countries. As stated in NeSPA 2010, the challenge set out in the national developmental agendas is to find ways to deliver e-skills capacity (e-astuteness) to communities so that they have a visible impact on the national goals and then to monitor the process in ways that inform continuing effort within the context of a developmental state.

Effective use existing resources

One of the key priorities which emerged from the e-Skills Summit 2010 was the need for the coordination of existing e-skills capacity and resources to maximize impact, reduce duplication of effort, and act as a focal point for the development of measureable e-skills competencies. Consequently, one of NESPA 2010 objectives was to build a committed national approach for e-skills priorities through coordinated collaboration with key stakeholders (government, businesses, education, civil society, organized labour) in ways that allow their contribution of existing human, technical and financial resources in mutually beneficial ways. It was proposed that this could be achieved through formalised network architecture of cooperation between these stakeholders. This formalised approach which would recognise and valorise individual agency value propositions would provide a means to optimise resource utilisation in order to effectively implement policies, plans and programs for economic development. The more than 300 thought leaders who attended the Summit and who laid out the key components of the NeSPA 2010 believed that without this formal coordination architecture there was a very high probability of continuing failure and significant waste of resources. In this sense it is useful contemplate the falling position of South Africa in the global e-readiness rankings.

Start with a few overarching projects

There was a very clear message from the e-Skills Summit 2010 and the consultation process that led to the Summit that the implementation of the National e-Skills Plan of Action should start with a small number of overarching project/programs that would provide a platform for subsequent action. In this context, the following criteria should be considered (NeSPA, 2010): (i) project’s leveraging capability in terms of making use of the existing projects that could incorporate the e-skills capacity development agenda, existing working environment and existing facilities and resources, (ii) projects that were capable of accelerating the e-skills agenda in South Africa, (iii) projects that could capitalise on a broadband capacity in South Africa, (iv) in order to achieve the necessary enthusiasm for e-skills development amongst all stakeholders, the showpiece projects should have a priority; and (v) from a policy development perspective, projects that could utilise the past research and already formulated policies should have precedence.

Introducing “smart” e-Skills: e-Astuteness and e-Social astuteness

The 2nd e-Skills Summit (Cape Town, October 2012), jointly held with the International Telecommunication Union’s (ITU) Global ICT Forum on Human Capital Development, provided the e-SI and various e-skills stakeholders (business, government, education, organised labour, civil society organisations) and the international partners (e.g. UNDP, ITU, CISCO) with the opportunity to “take stock” of what had been achieved in the previous two years and also to forge the way forward for e-skilling the South African nation. More than 350 national and international delegates agreed that a major e-skilling agenda in South Africa was required to make a ‘profound
difference’ in people’s lives: to address poverty, to develop an active citizenry that was capable of contributing to “people centred development” and establishing a capable and developmental state.

The Summit reinforced the reality that ‘traditional core’ e-skills capacity development, i.e. skilling people for using ICT (hardware, software, networks), although necessary, was not sufficient to improve inequity and to build an inclusive economy that could sustain itself in a world increasingly dominated by pervasive ICT which increasingly embedded new, unavoidable technological applications including social media. This almost inevitably meant that the ‘smart’ countries were getting ‘smarter’ and the developing countries were being left further behind despite the reality that most of the recent innovations in ICT (including capacity, mobility, accessibility and cost) had the capability to provide greater advantage to developing countries (ITU-Summit, 2012). Hence, a new approach to ‘e-skills capacity development’ was needed to achieve a positive impact on meeting the goals and aspirations of South Africa’s strategic plans (NeSPA, 2013).

Mitra (2005, 2006, 2012) has demonstrated the power of learning networks (peer-to-peer) and self-organising systems in the adoption of ICT devices for local benefit in low socio-economic situations. Hence, it was concluded that some social and ‘developed intuition’ related skills (‘soft’ skills) needed to be included in the e-skills capacity development agenda, if the majority of citizens were to successfully apply e-skills in their everyday lives: be it for economic (e.g. employment readiness or starting and running an own business), service delivery, education and training or social (e.g., building more cohesive and safer communities) purposes (NeSPA, 2013). Hence, the National e-Skills Institute introduced a concept of ‘astute’ use of e-skills for personal growth and self-reliance (e-Astuteness) into its strategic plans the Second e-Skills Summit (ITU-Summit, 2012). The concept of e-astuteness is not confined to the formally educated but encompassed developed and existing capability across the full spectrum of society that would allow individuals and collectives (business, education, social and family) to harness ICT for individual or group benefit.

The concept of e-Astuteness is directly based on the notion of astuteness, which is by various dictionaries define as “the acute, keen intellect” (The Funk & Wagnalls Dictionary, 1943), “having or showing a clever or shrewd mind” (Webster’s online dictionary, 2005) or “clever; keen, acute, bright; shrewd; perceptive” (Oxford Babilon Dictionary, 2012). Conceptually, e-Astuteness is “a dependent construct that is based on personal and interpersonal skills of individuals and is reliant on building a knowledgeable capacity and creating a mind-set that embraces all forms of technology and prepares users for future forms of technology and their possible socio-economic applications” (Mitrovic et al., 2013). It is believed that e-astuteness can help individuals (i) to understand people (local cultures) and situations better, (ii) to build beneficial alignment and alliances (networks – local, national and international – personal, learning, business and services) and (iii) towards better understanding of the current strategic socio-economic and technological directions within local applicability. Furthermore, the concept of e-Astuteness assumes that individuals should possess certain e-skills so that they can apply both operational and strategic behaviour in the use of modern ICT for achieving individual socio-economic benefits. In practice e-astuteness may result in quite simple applications (so-called ‘apps’), which can deliver relatively small individual benefits at the outset. However, the concept of ‘scale’ (‘economies of scale’) across cultures, socio-economic circumstance, profitability and alike is fundamental to the power of modern ICT to shift value propositions (Mitrovic et al., 2013).

If e-astuteness is used in the social context it ‘becomes’ e-Social Astuteness, a construct that can be viewed as the use of ICT and e-skills for more astute ways of people interacting with others for a collective socio-economic benefit. This is related to a process of (i) involvement in a network of social interactions, (ii) having a collective level of awareness and understanding diverse social situations, (iii) the identification of socio-economic needs and opportunities that could be met with ICT enabled applications, (iv) the examination of various alternatives, (v) the development,
testing and modification of options, (vi) the assessment of ‘fit’ of value proposition i.e. success or failure and applicability and (vii) network supported adoption and scaling (Mitrovic et al., 2013). The concept of e-Social Astuteness is also a dependent construct and is primarily built on e-Astuteness but applied in a networked community socio-economic context. Hence, developed e-Social Astuteness can be used, together with the acquired e-skills, for more astute ways for socially interacting with other community members.

There are numerous advantages of community based capacitation of e-Astuteness and e-Social Astuteness in everyday life in a wide range of socio-economic contexts but particularly in developing countries where there are wide ranges in literacy, inequity, language, culture, dependency and alike, be it in economic or social contexts.

**Conclusion**

E-Skills capacity development in a societal sense is a diverse, broad and pervasive matter involving multiple stakeholders across business, education, civil society and government. It involves legitimate activity at a host of levels from peer-to-peer at the personal level through the hierarchies of society across all the stakeholder categories. Hence delivering a societal e-skills capacity development approach aimed at preparing a Nation to be better respond to the challenging Information Society and the emerging Creative Knowledge Societies cannot be easily met by relying solely on a traditional scientific approach to research, policy development, service delivery and evaluation. Often such approaches rely upon a concept of subsequent general societal ‘diffusion’ (passive) and not on a concept of ‘adoption’ (proactive). Adoption is fundamental to preparing society to meet both the challenges of inequity and the opportunities of ‘inclusion’ in the emerging ICT driven age. Nor can addressing the gaps be effectively dealt with through traditional methods of formal education, training and marketing. E-skills as defined in the South African context are not always visible, do not always provide an immediate tangible benefit and are not always easily described or measured. Hence, the approaches which are well suited to tangible products, direct measurement and immediate benefit are insufficient by themselves to address the immediate needs of South Africa in preparing itself to maximise the obtainable benefits of increasingly pervasive modern ICT devices and applications which are increasingly suited (mobility, accessibility, affordability, vision enhanced) to developmental states. Further, the multiplicity of sectoral effort, which understandably services secular interests, is uncoordinated and does not provide an adequate base for synergy for effective service delivery, engagement or policy development. Up until recently, the focus on ‘access’ has dominated this space, but convergence in technological capacity (e.g. cell phones) and reducing capital and operating costs, now shifts the emphasis to ‘effective use’ and social appropriation. These matters are the next looming barrier to equity, self-reliance, participation, government service delivery, improving life chances and in dealing with every one of the major societal matters that South Africa faces. The fact that South Africa - and many other developing countries in Africa and worldwide - faces the problem of massive under development in e-skills capacity development makes these points self-evident.

Addressing these matters in a substantive manner requires a collaborative, integrated, embedded, strongly supported and inclusive approach to research, evaluation and policy development.

**Future Research Directions**

Clearly what is now required is a strong research agenda that supports the concepts of the ‘quadruple helix’ (government, business, education and civil society) approaches to addressing complex problems. At this point in time traditional discipline based research lacks the coordination mechanisms that can deliver visible and tangible results against impact on societal goals. The GITR (the networked e-readiness index which underpins the annual Global IT Report by WEF
and INSEAD) makes a sound start by proposing a set of components or variables that can be aggregated into a concept of e-readiness.

However, developing a coherent and integrated approach to addressing components that fall below comparable levels yet needs to be appropriately developed. Further, whilst macro-economic approaches have identified some links between the adoption of ICT and the Gross Domestic Products (GDP), there needs to be a lot more effort applied to defining component contribution to national strategic goals that can better interpret the impact of interventions such as e-skills capacity development. In times of increasing austerity by governments, particularly as far as education and research are concerned, there needs to be a lot more emphasis on providing the architecture that can bring the components together in coherent and beneficial manner to demonstrate impact. At the local level, there are a host of socio-cultural matters which impact the rate of effective appropriation of modern ICT devices and application for local individual and collective community benefit. It is more than obvious that traditional techno-deterministic, socio-economic, government service delivery and financial business models do not adequately address real and emerging value propositions that are now becoming more visible as ICT applications develop and cause substantive paradigm shifts. Whilst a number of large research funders are beginning to grapple with these matters with in a developed economy context, the transfer of such approaches to developing economies has yet to find continued success.

References


Key Success Factors for Developing e-Skills in a Developing Country


Biographies

**Dr Zoran Mitrovic** is the Coordinator of the Masters in Information Management Programme at the University of the Western Cape, South Africa. He is the leading author of the South African National e-Skills Plans of Action (NeSPA 2010 and NeSPA 2013). His research and consulting praxis encompasses the development of e-skills in the developmental context, the use of ICT for local socio-economic development, e-government policies and praxis, and the ICT-supported open government. He works with all spheres of government and international organizations such as UNDP.

**Prof Wallace Taylor** is the founding director of The Information Society Institute (TISI), which is currently engaged with the South African Department of Communications e-Skills Institute in addressing national and international issues involved in the social appropriation of ICT for local socio-economic benefits. Prof Taylor is also Honorary Professor the University of the West Indies. His current research and praxis interests are focussed on the social appropriation of ICT, public policy development, the role of higher education in the information society and building self-reliance for civil society inclusion. Prof Taylor was named as Citizen of the Year by the City of Rockhampton (Australia) in 2001 for his contribution to community development, the initiation of a range of community and industry events, organisations and programmes. He is co-author of the South African National e-Skills Plans of Action (NeSPA 2010 and NeSPA 2013).

**Mymoena Sharif** is the Chief Director of the Department of Communications iKamva National e-Skills Institute, a South African government initiative to advance and implement key e-skills interventions. She is a member of the Strategic Council for the United Nations Global Alliance on ICT for Development and is a former winner of the Bill & Melinda Gates International Access to Learning Award. She is co-author of the South African National e-Skills Plans of Action (NeSPA 2010 and NeSPA 2013).
Problem-Solving and Web-Based Learning

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Abstract

This article investigates the relationship between Web-based learning and Problem-solving in a web-based course on the fundamentals of Information Technology at a university in Montreal, Canada. We assess for the different learning components of the course, the extent of problem-solving skills acquisition including research, creativity and critical thinking skills. The course entailed two categories of learning, namely resources-based and interactive components. The study aimed at answering the following questions: (1) To what extent is problem-solving skill acquisition explained by the acquisition of the other three skills? (2) To what extent do students understand the definitions of Problem-solving, Research and Creative Idea Generation skills, and Critical Thinking skills? (3) What is the effect of the learning modules in the course on these skills? and, (4) What is the relative contribution of the various learning modules to the acquisition of Problem-Solving, Research, and Creative Idea Generations skills, and Critical Thinking skills?

Keywords: critical thinking skills, information technology, problem-solving, web-based learning

Introduction

Problem-solving, as an outcome or dependent variable, is not to be confused with problem-based learning, which is an input or independent variable. Compared to problem-based learning, the body of knowledge for problem-solving in higher education is significantly less. In Bloom’s famous Taxonomy of learning, problem-solving encompasses the three lower levels - analysis, synthesis, evaluation, and in the revised taxonomy - analyzing, evaluating, creating (Anderson & Krathwohl, 2001; Bloom & Krathwohl, 1956). Missing, however, is the requisite need for researching the problem and the potential solutions (Jonassen, 1997; Saade et al., 2012). According to Hennessy, McCormack and Murphy (1993)
and ITS Education Asia (n.d.) problem-solving requires a controlled mixture of analytical and creative thinking.

Problem-solving then, can be viewed as an umbrella term, supported by a tripod of skills encompassing, research, creative idea generation, and critical thinking (Thomas, 2001), but this may not tell the whole story (Figure 1). In this paper, the following definitions are used (Thomas, 2001):

**Problem-solving**: deriving alternatives and solutions for complex problems/issues with incomplete information, this is built on:

1. **Research skills**: investigating, finding, and synthesizing information from multiple sources;
2. **Creative idea generation**: ideas that are novel or unique; and
3. **Critical thinking**: analysis, inference, reasoning, evaluation, explanation, interpretation.

![Figure 1. The Problem-Solving Tripod](image)

Considering these definitions and the multi-national context of the university and course student body, a questionnaire was devised and administered to study how these problem-solving skills were perceived in an online information technology course. In specific, students were asked to provide a subjective assessment of the extent to which they felt various activities, resources and technologies supported their acquisition of the above mentioned skills, as defined in an entirely virtual, online course.

This study provides two significant contributions: (1) At a macro level, obtain some understanding of problem-solving, and its relationship to its subcomponents of research, creative idea generation, and critical thinking skills, in the online learning context (higher education), and (2) At a micro level, identify the kinds of resources and activities that foster / require these problem-solving skills. With this knowledge, practitioners (teachers and online courses designers) can design and implement better online (web-based) courses by integrating learning tools to foster the development of problem-solving, and associated research and creative idea generation skills, and critical thinking skills.

**Background**

According to Beachboard and Aytes (2013, p. 16):

> Decision-making is directly associated with selecting one course of action among two or more possible alternatives. Decision-making is driven by a desire to solve problems or exploit opportunities. A problem refers to some type of event that requires a response to avoid a negative consequence. Conversely an opportunity is an event or situation where a response is required to make something desirable happen.
When it comes to scholastic and professional performance, problem-solving is a key skill that individuals need in order to succeed (Johnson et al., 2010; Pedaste, Pentjärv, & Sarapuu, 2003). The Big Six information problem-solving process proposed in Eisenberg and Berkowitz (1988) suggests that problem-solving requires defining the task and identifying the information needed to solve it, determining sources for the information, locating the sources and the information, extracting the information, synthesizing the information, and evaluating the information. It is regarded as one of the most important skills needed to be able to handle the novel, changing requirements of any job function, and in the current information age, how to bring technology to bear on this problem-solving (Hennessy, McCormick, & Murphy, 1993). As Eisenberg and Johnson (1996, pp.1-2) noted, this means going beyond the how of technology use, to the when and why, what they refer to as true computer literacy. That means “knowing the basic operations, terminology, and maintenance of equipment; knowing how to use computer-assisted instructional programs and other specialized, task-specific applications; having a knowledge of the impact of technology on careers, society, and culture; knowing computer programming”. The acquisition, understanding, and use of knowledge require various learning strategies, meta-cognitive skills and the desire to use them. In order to learn in the academic environment, as well as to perform well later in the workplace, students need the skills to acquire, absorb, and transfer knowledge efficiently and effectively (Eisenberg & Berkowitz, 1988). This implies being able to apply problem-solving skills, and associated research and creative idea generation skills, and critical thinking skills, to situations as they arise.

There is a scant body of research work on problem-solving in virtual learning environments, as opposed to problem-based learning for which there is more research. While performance as an outcome variable can be found in studies, it is usually a measure of scores on exams or assignments, rather than specifically a measure of problem-solving, let alone the associated research and creative idea generation skills. In contrast, the literature on critical thinking skills is extensive (Saadé, Morin, & Thomas, 2012), but not in association with the other skills identified here.

**Methodology**

Davis (1989) has shown that system use is tied to user’s perceptions, while Keengwe (2007) and Koohang and Durante (2003) found that a relationship exists between students’ personal computer proficiency and students’ perceptions of the effect of computer technology to improve their learning. Song, et al. (2004) focused on students’ perceptions as a way to improve online or distance learning. Perceptions are, therefore, important considerations when integrating technology into learning, especially virtual learning. Building on prior research conducted by the authors, the survey used in this study measures the subjective evaluation of the students’ use and/or development of problem-solving skills, research skills and creative idea generation skills, as well as critical thinking skills, while interacting with the course resources, activities and technologies (Morin, Thomas, & Saadé, 2012; Thomas & Morin 2010).

**The Course**

The course used in this study is “Fundamental of Information Technology and Business Productivity” and is offered by the business school. This course is offered to all students entering the business school and do not meet information technology admission requirements. At the same time, many students from other faculties take this course as an elective. Approximately, 50% of the students who take the course are outside of the business school. The course is completely online and virtual with no face to face contact with the teaching assistant or the professor. There are however weekly office hours held by the teaching assistant where only few students take advantage. Approximately 2700 students enroll in this course every year.
From an instructional design perspective, the course includes practice quizzes, readings, proctored exams, video and audio, business problem solving cases, Excel and Access simulations and assignments. In essence the course entails many activities that require students to not only learn the content but also establish interconnections between them to specific context.

The purpose of this research was to investigate what observations could be made about students’ acquisition of an important aspect of higher-order learning, namely problem-solving, with supporting research, critical thinking and creative idea generation skills. In such a course, students are required to demonstrate acquisition of lower level skills, such as remembering concepts as well as keystrokes in software, and additionally, how to solve problems with the software being learnt. Learning in the course is supported by various activities and resources, as well as by technology. The activities are assignments, an Excel project, an Access project, and quizzes, in addition to an educational information system for enhanced learning (EISEL). The resources are the textbook, the online book chapters, the overall online system and the material on the web.

The Survey

A survey methodology was used for data collection. At the end of the semester, students were asked to respond to the survey as candidly as possible. The survey used in this study is based on an instrument developed by the second author (Thomas, 2001). Students were instructed that there were no right or wrong answers and that the interest was primarily in their beliefs and perceptions about the course components and their experiences with the different tools for learning. The survey was divided into three major parts. The first part contained demographic questions, such as gender, age, level of computer experience and mother tongue. The second part was about the students’ level of understanding of definitions and the third part was about perceptions. For each of the four skills, namely Problem-solving, Research, Creativity and Critical Thinking, students were asked to identify at what level each of the class activity and resources contributed to the development of these skills.

Discussion and Analysis of Results

Demographics and Definition Understanding

There were a total of 985 students enrolled in the course and 490 of them completed the survey online for a response rate of 51.2%. Of those who completed the survey, 44% were female students. Most respondents (73.3%) were in the 20-23 age group, 17.4% in the 24-30 age group and 4% and 5.3% were in the below 20 and above 30 categories, respectively. The average age is 22.7 years, while the median is 22. Figure 2 shows the distribution of the scores representing students’ understanding of the definition of the four skills used in the survey. A score of 0 indicates ‘Not at all’ and a score of 10 indicates ‘Perfect understanding’. The definitions are, as previously stated:

- **Problem-solving**: deriving alternatives and solutions for complex problems/issues with incomplete information
- **Research**: investigating, finding, and synthesizing information from multiple sources
- **Creativity**: ideas that are novel or unique
- **Critical Thinking**: analysis, inference, reasoning, evaluation, explanation, interpretation

The frequency distributions illustrated in Figure 2 using a parallel bar-chart, can be categorized into three groups: ‘perfect understanding’ (score = 10), ‘average understanding’ (score from 7 to 9) and ‘limited understanding’ (score of 6 or below).

From Figure 2 and Table 1, it can be observed that 77.5%, 72.08% and 77.50% of students have at least a moderate or better understanding of the definition of Problem-solving, Creativity and
Critical Thinking skills, respectively. The definition of Research skills is the least understood by students with 31.67% having limited understanding, which could be due to the fact that this is a group of mainly first year undergraduate students. Nonetheless, 68.3% had moderate or better understanding of the definition.

![Figure 2. Understanding the Definitions from 0 to 10](image)

<table>
<thead>
<tr>
<th>Definition</th>
<th>Problem-solving</th>
<th>Research</th>
<th>Creativity</th>
<th>Critical Thinking</th>
</tr>
</thead>
<tbody>
<tr>
<td>Perfect</td>
<td>10</td>
<td>37.08%</td>
<td>35.00%</td>
<td>38.75%</td>
</tr>
<tr>
<td>Moderate</td>
<td>7 to 9</td>
<td>40.42%</td>
<td>33.33%</td>
<td>33.33%</td>
</tr>
<tr>
<td>Limited</td>
<td>0 to 6</td>
<td>22.50%</td>
<td>31.67%</td>
<td>27.92%</td>
</tr>
<tr>
<td>Average score</td>
<td></td>
<td>7.90</td>
<td>7.51</td>
<td>7.80</td>
</tr>
</tbody>
</table>

**Table 1. Distribution of the Scores of Understanding the Definition**

**Contribution of Activities and Resources**

Students were asked to assess how different activities and resources in the course have assisted them in the development of their Problem-solving skills, Research skills, Creativity and Critical Thinking skills, using the following classification: ‘A lot’ (3), ‘Moderate’ (2) and ‘Not at all’ (1). In tabulating the results, this coding was used and the averages of ranking of students are shown in Table 2.

These means provide a measure of the perceived relative influence of course elements (activities/resources) on the development of skills. The table also presents the Positive impact of each activities / resources defined as the total proportion of answers in the categories ‘Moderate’ and ‘A lot’. The last column gives the average perceived contribution of each activity and resource to the combined set of skills: Research, Creativity and Critical thinking as well as the average positive impact. It is observed that the results in this last column are never as high as those of the Problem-solving skills column which is an indication that although they explain a good portion of Problem-solving skills acquisition, the entire story is not told.
Table 2. Students’ Perceived Contribution of Activities and Resources to the Components of Problem-Solving (PS)

<table>
<thead>
<tr>
<th></th>
<th>N</th>
<th>Problem-solving (PS)</th>
<th>Research (R)</th>
<th>Creativity (C)</th>
<th>Critical Thinking (CT)</th>
<th>Aggregate contribution (R,C,CT)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Mean + impact %</td>
<td>Mean + impact %</td>
<td>Mean + impact %</td>
<td>Mean + impact %</td>
<td>Mean + impact %</td>
</tr>
<tr>
<td>Activities</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Assignments</td>
<td>484</td>
<td>2.37 91.7%</td>
<td>2.24 85.0%</td>
<td>2.11 78.8%</td>
<td>2.20 84.3%</td>
<td>2.18 82.7%</td>
</tr>
<tr>
<td>Excel project</td>
<td>487</td>
<td>2.37 90.1%</td>
<td>2.23 83.4%</td>
<td>2.17 81.1%</td>
<td>2.21 82.2%</td>
<td>2.20 82.2%</td>
</tr>
<tr>
<td>Access project</td>
<td>483</td>
<td>2.31 87.4%</td>
<td>2.18 79.7%</td>
<td>2.14 77.1%</td>
<td>2.18 81.4%</td>
<td>2.17 79.4%</td>
</tr>
<tr>
<td>Quiz</td>
<td>487</td>
<td>2.16 83.5%</td>
<td>2.11 79.5%</td>
<td>1.81 59.5%</td>
<td>2.18 80.7%</td>
<td>2.03 73.2%</td>
</tr>
<tr>
<td>EISEL</td>
<td>487</td>
<td>2.19 84.7%</td>
<td>2.07 75.1%</td>
<td>1.76 57.4%</td>
<td>2.13 79.4%</td>
<td>1.99 70.6%</td>
</tr>
<tr>
<td>Resources</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Textbook</td>
<td>365</td>
<td>2.05 78.4%</td>
<td>1.95 77.0%</td>
<td>1.88 65.7%</td>
<td>1.95 73.4%</td>
<td>1.93 72.0%</td>
</tr>
<tr>
<td>Online book chapters</td>
<td>488</td>
<td>2.00 75.0%</td>
<td>1.95 74.5%</td>
<td>1.83 66.1%</td>
<td>1.90 71.9%</td>
<td>1.89 70.8%</td>
</tr>
<tr>
<td>Overall online system</td>
<td>484</td>
<td>2.15 87.7%</td>
<td>2.10 82.9%</td>
<td>1.94 70.2%</td>
<td>2.07 78.7%</td>
<td>2.04 77.3%</td>
</tr>
<tr>
<td>Material on the Web</td>
<td>489</td>
<td>2.12 81.8%</td>
<td>2.16 82.7%</td>
<td>1.99 72.9%</td>
<td>2.10 81.4%</td>
<td>2.05 79.0%</td>
</tr>
</tbody>
</table>

Approximately 75%, (365/490 - those who answered the questions about the textbook divided the total sample size) of the students bought the physical textbook and, from the results in Table 2, about 78.4% of them considered that it had a positive impact on the acquisition of Problem-solving skills. Similarly, the perceived contribution of the Online book chapters to Problem-solving was positive, though lower at 75%. Moreover, it seems that students felt that most activities contributed more to skills improvement than did resources. In terms of the strongest positive impact, Assignments, Excel project and Access project generally are perceived as having contributed the most to skills development. On the other hand, and not surprisingly, the Quiz, the Textbook, the Online book chapters, and EISEL, were perceived to contribute the least to the development of creativity skills.

**Perceptions and Understanding of the Definitions of Components of Problem-Solving**

In order to assess whether students’ understanding of the definitions is correlated to the perception of the contribution of the activities and resources to the skills development, a correlation analysis is presented in Table 3.

Table 3 shows that most correlations are not significantly different from 0 at the 5% level, except in the cases of problem-solving and creativity. The perceived contributions of the Assignments and Access project to problem-solving seem to increase with the understanding of the definition. The fact that students’ perceptions increased with understanding of the constructs, suggests that students don’t always know what they are learning, and that, when they do, they appreciate it more. Understanding and learning begets more understanding and learning.
Table 3. Correlations Between Understanding of Skills Definition and Perception of Contribution of Activities/Resources to that Skill

<table>
<thead>
<tr>
<th>Activities</th>
<th>Understanding of definitions of skills</th>
<th>Research</th>
<th>Creativity</th>
<th>Critical Thinking</th>
</tr>
</thead>
<tbody>
<tr>
<td>Assignments</td>
<td>0.135*</td>
<td>0.074</td>
<td>-0.037</td>
<td>0.020</td>
</tr>
<tr>
<td>Excel project</td>
<td>0.075</td>
<td>0.036</td>
<td>0.005</td>
<td>0.053</td>
</tr>
<tr>
<td>Access project</td>
<td>0.094*</td>
<td>0.080</td>
<td>-0.031</td>
<td>0.058</td>
</tr>
<tr>
<td>Quiz</td>
<td>0.047</td>
<td>0.050</td>
<td>-0.090*</td>
<td>0.042</td>
</tr>
<tr>
<td>EISEL</td>
<td>-0.012</td>
<td>0.003</td>
<td>-0.107*</td>
<td>0.034</td>
</tr>
<tr>
<td>Resources</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Textbook</td>
<td>-0.048</td>
<td>0.028</td>
<td>-0.077</td>
<td>-0.088</td>
</tr>
<tr>
<td>Online Book Chapters</td>
<td>0.015</td>
<td>0.287</td>
<td>-0.076</td>
<td>0.010</td>
</tr>
<tr>
<td>Overall Online System</td>
<td>0.060</td>
<td>0.053</td>
<td>-0.025</td>
<td>0.046</td>
</tr>
<tr>
<td>Web Material</td>
<td>0.009</td>
<td>0.090</td>
<td>-0.026</td>
<td>-0.023</td>
</tr>
</tbody>
</table>

* Correlation significantly different from 0 at 5% level

On the other hand, the perceived contributions of the quizzes and of EISEL to creativity seem to decrease with the understanding of the definition of creativity. As students’ understanding of the definition of Creativity increases, their perceptions of the contribution of Quizzes and EISEL decreases. This makes sense since Quizzes, an activity, and EISEL, a resource, are practice tools and not primarily tools for developing Creativity.

**Relationship of Research, Creativity and Critical Thinking to Problem-Solving**

In this research, it was hypothesized that the Problem-solving skill is partially explained by three other skills, namely Research, Creativity and Critical Thinking. This is supported by Table 4 where multiple regressions show that the variation in the perceived contribution to Problem-solving skills is explained by the regression on the three other perceived contributions.

It can be observed that all multiple regressions are highly significant with p-value of 0.000, which means that perceived contributions of activities and resources to Problem-solving skills are explained by their contribution to Research, Creativity and Critical Thinking. Therefore, Problem-solving stands on three legs: Research, Creativity and Critical Thinking. Therefore, Problem-solving stands on three legs: Research, Creativity and Critical Thinking, as had been hypothesized, however, the coefficients of determination indicate that they do not tell the entire story; other factors are also at play and need further research.

Focusing in on the impact of the activities and resources on problem-solving, it is noted that 55.76% of the variation in the perceived contribution of the Excel project to Problem-solving skills is explained by the contribution of the Excel project to Research, Creativity and Critical Thinking, where Research is the most significant predictor. Similarly 54.2% of the variation in the perceived contribution of the ACCESS project to Problem-solving skills is explained by the contribution of the three skills and Critical Thinking and Research are the most equally important predictors. This could be explained by the fact that Access needs deeper understanding of the tools to be utilized. It is likely that critical thinking will be used more in ACCESS than in Excel, because of the nature of those programs. The perceived contributions to Problem-solving skills of the other activities: Assignments and Quiz are also partially explained (40.48% and 50.47%, respectively) by their perceived contributions to the three skills, where Research and Critical thinking are, respectively, the most significant predictors.
Table 4. Perceived Contribution of Research, Creativity and Critical Thinking as Predictors of Perceived Contribution to Problem-Solving Skill for each Activity and Resource

<table>
<thead>
<tr>
<th>Activities</th>
<th>Coefficient of Determination</th>
<th>Significance</th>
<th>N</th>
<th>Most significant predictor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Assignments</td>
<td>40.48%</td>
<td>0.000</td>
<td>469</td>
<td>Research</td>
</tr>
<tr>
<td>Excel case (project)</td>
<td>55.76%</td>
<td>0.000</td>
<td>474</td>
<td>Research</td>
</tr>
<tr>
<td>ACCESS case (project)</td>
<td>54.20%</td>
<td>0.000</td>
<td>468</td>
<td>Critical Thinking/ Research</td>
</tr>
<tr>
<td>QUIZ</td>
<td>50.47%</td>
<td>0.000</td>
<td>472</td>
<td>Critical thinking</td>
</tr>
<tr>
<td>EISEL</td>
<td>44.36%</td>
<td>0.000</td>
<td>470</td>
<td>Critical thinking</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Resources</th>
<th>Coefficient of Determination</th>
<th>Significance</th>
<th>N</th>
<th>Most significant predictor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Textbook</td>
<td>43.34%</td>
<td>0.000</td>
<td>353</td>
<td>Creativity</td>
</tr>
<tr>
<td>Online Book Chapters</td>
<td>43.24%</td>
<td>0.000</td>
<td>473</td>
<td>Research</td>
</tr>
<tr>
<td>Overall Online System</td>
<td>54.57%</td>
<td>0.000</td>
<td>468</td>
<td>Creativity</td>
</tr>
<tr>
<td>Web Material</td>
<td>63.67%</td>
<td>0.000</td>
<td>477</td>
<td>Research</td>
</tr>
</tbody>
</table>

As for the resources in the course, Table 4 indicates that the perceived contribution of the Web material to Problem-solving is explained more (63.67%) by its perceived contributions to the other three skills than by the perceived contribution of any other resources (43.34%, 43.24% 54.57% and 44.36%) and even activities. The most significant predictor is Research, which could be explained by the fact that students have to search the course content and distinguish between important and less important elements of the course. Similar results are found for the Online book chapters but to a lesser extent, with a coefficient of determination of 43.24%. For the Textbook and the Overall online system, Creativity is the most significant predictor, while for EISEL, Critical thinking is most significant.

Conclusions

The regression analyses supported the hypothesis that research, creative idea generation and critical thinking are strong supporting legs of problem-solving, but did not tell the full story. Other factors are involved and need further investigation and elaboration.

Level of understanding varies across the skills and in general among students but about three-quarters of students had at least a moderate understanding. As the understanding of the definition of Problem-solving increases, the perceived contribution to this skill, of the Assignment and Access project also increase. On the other hand, as the definition of Creativity increases, the perceived contribution to the Quiz and EISEL decreases.

Students clearly had an average to better than average understanding of the definitions given of the constructs, as well as perceived contribution of the activities and resources of the course to their development. Certain activities and resources were perceived to contribute more than others, which were the Assignments and the Excel and Access projects. The Quiz, the Textbook, the Online book chapters, and EISEL, were perceived to contribute the least to the development of creativity skills. It also seems from the regression analysis that the perceived contribution of the Activities to problem-solving skills is largely explained by research and critical thinking skills, while for Resources it is research and creativity.

These results have implications for the design of web-based delivery of learning content. Understanding those aspects of a course that can contribute to developing problem-solving skills, and the other supporting skills, research, creativity and critical thinking, can assist in this process and
needs further study. The authors are not aware of other studies which have looked at these elements in quite the way presented in this study and the results found suggest the need for further study and elaboration of these ideas. Possible expansions of this study include looking at the effect of team-building skills on the elements of problem solution, which is the topic of a subsequent paper, as well as expanding the types and number of questions used in the survey.

In a recent study (Chia-Wen & Yi-Chun, 2013) where a review of research in problem-based learning in online education environment was performed, the authors report on the number of publications per target student groups. What is interesting is that over the 8 year period, 63 articles were published, giving an average of 8 articles per year. If only higher education students are considered, the number of publications falls by around 25%. Needless to say, research in online education and problem-based learning is scarce, even more so if one considers problem-solving skills acquisition in particular. Conducting a small research on Google Scholar on higher order thinking and eLearning resulted in less than 10 articles over the past 5 years.

It is clear that the study of various higher order thinking skills in eLearning environments (online education) is scarce and therefore any insights that can be used to further the understanding via comparative synthesis are rare and therefore making the task the more difficult. However, in a study performed by Fox & Mackeogh (2003) on eLearning’s ability to promote higher-order learning via different pedagogical methods, it was suggested that given the appropriate pedagogical design, students can develop effective ways of engaging with the online course activities showing evidence of engaging in higher-order learning. This is in-line with the present study findings and supports the results that pedagogically sound online activities can engage students in higher order learning.

References


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Understanding Collective Moral Disengagement in a Controversial Urban Electronic Tolling Project: Implications for e-Skills Education

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Abstract

This case study analyses modes of collective moral disengagement used by decision-makers to justify a controversial urban electronic tolling project in South Africa. Legal documents and public records were coded for these modes using deductive content analysis. The results suggest the following modes were present: endowing the project with socially worthy purposes; euphemistic labeling; displacing and diffusing responsibility; downplaying negative consequences; making favorable comparisons; and disparaging and blaming dissidents and victims. The empirical examination provides an alternative theoretical path to understand how collective moral disengagement can sometimes lead to decision-makers surrendering their rational decision-making abilities. Several guidelines are offered for educators keen to promote moral engagement in the classroom setting. Future research needs to investigate how educators can morally engage students involved in complex and controversial technology decisions.

Keywords: decision-making, ethics, technology, moral disengagement, e-skills, case study

Introduction

Although ordinary people may care about behaving ethically, they tend to justify and distance themselves from their unethical behaviour in everyday life (Tenbrunsel, Diekmann, Wade-Benzoni, & Bazerman, 2010). Similarly, public managers are vulnerable to moral and ethical issues whenever they engage in actions that can harm or benefit others (Gauld & Goldfinch, 2006). This poses an interesting dilemma in an era of new information and communication technologies that have improved the ability to collect and manipulate the personal information of citizens for a variety of commercial ends (Walsham, 2012). While technologies can play an important role in reducing the administrative and operational costs, as well as enhancing the services that central and local government deliver to citizens and businesses, they can also bring about a lack of focus and clarity to alternative, more ethical and cost-effective avenues of action to follow in a wide range of service delivery situations. An over reliance on both technologies and their private sector providers can even obscure the state's priorities (Naidoo, 2013; Rose-Ackerman, 2002; Van Slyke, 2003). For instance, the increas-
ing surveillance capability of technologies can be used for political ends (e.g., staying in power) and private interests ends (e.g., profit). Yet, effective technology investments can contribute positively to the state’s credibility with citizens and provide political return for leaders (Savas & Schubert, 1987). However, this requires that public managers must hold themselves collectively accountable for their actions when they enter into these investment decisions.

Despite a growing awareness that decision-making in general is not an entirely objective rational process (Ariely, 2009; Milgram, 1963; Zimbardo, 2007), studies on irrational decision-making behavior have continued to make way for rational decision-making studies. Although advancing our knowledge in certain contexts, the objective rational approaches may be implicitly defending unethical decisions by dressing it up as being generally bounded by cognition or the limitations of moral heuristics (Simon, 1996; Sunstein, 2005) thereby somewhat neglecting the irrational side of human behavior. To some extent these perspectives treat irrational decision-making as atypical and reveal little about how people collectively normalize irrational decisions and unethical conduct. In this paper, it is argued that applying the moral disengagement mechanisms explained by social-cognitive theory to a case study of a controversial decision may offer a new perspective for researchers and fill some of the void present in existing ethical decision-making frameworks (Bandura, 1990, 1991). Recognition of moral disengagement psychological processes and how they are activated may also contribute to a potentially richer understanding of why public managers are prone to unethical and economically dubious decision-making. This type of understanding is also crucial if educators wish to integrate broader considerations such as ethics, equity and justice in e-skills education.

This study suggests a theoretical shift by acknowledging the existence of the irrational side of decision-making and by grounding its analysis in the social cognitive theory of moral agency (Bandura, 1990, 1991). According to Bandura (1991), moral disengagement is the self-regulatory process through which people free themselves from guilt and self-sanctions allowing them to engage in unethical conduct. This theory also asserts that being part of a group also neutralizes the implications of a person’s role and obscures their personal accountability in morally tenuous situations. Moral disengagement has been able to explain political and military violence, apathy with ecological sustainability, organizational corruption, corporate transgressions, illicit consumer behavior, unfair labor practices and the decline in civic behavior (Bandura, 2004, 2007; Bandura, Caprara, & Zsolnai, 2000; Bandura, Barbaranelli, Caprara, & Pastorelli, 1996; Beu & Buckley, 2004; Caprara, Fida, Vecchione, Tramontano, & Barbaranelli, 2009; Paharia & Deshpandé, 2009; Shu, Gino, & Bazerman, 2011; White, Bandura, & Bero, 2009). To date, the role of moral disengagement has not been fully investigated in a major technology decision. Since people use moral disengagement mechanisms to downplay the ethical content of their decisions and to make decisions that advance their organizational and personal interests, it is reasonable to assume that these mechanisms will play an important role in explaining a controversial technology decision. It will be interesting to observe whether moral disengagement mechanisms facilitate the exclusion of moral considerations in these decisions. This study therefore seeks to contribute to knowledge about ethical decision-making in a complex technology project by exploring the notion of moral disengagement as the process which influences morally dubious or unethical decision-making behavior.

Specifically, the purpose of this research is to answer the following question: What were the collective moral disengagement strategies that were used by public managers to justify a morally questionable technology decision? Educators can use this knowledge to teach students to recognize that e-skill decisions are also not free from ethical dilemmas. A continued emphasis on the current, arguably overly amoral approach to e-skill education may result in students relinquishing their moral or ethical responsibilities to broader society (Ghoshal, 2005).
Theoretical Framework

Social cognitive theory provides an appropriate conceptual apparatus to understand how learning occurs in a social context (Bandura, 2001). It views learning as a product of continuous interaction between personal and contextual factors. For instance, learning is shaped by factors within the classroom environment but is also affected by a student’s individual experience of the classroom context. While SCT acknowledges that people have agency over their own learning, it also retains the importance of the learning environment in influencing student behavior.

SCT also provides a useful approach to assess structures and processes through which moral agency operate in the realm of complex technology decision-making and to guide interventions aimed at promoting desirable or ethical decision-making behaviors (Bandura, 1991). This theory assumes that people reflect on the consequences of their conduct, pursue goals in accordance to their own standards, enact actions that give them satisfaction and self-worth and avoid behaviors that carry self-censure. Yet people can violate the principles of desirable and ethical decision-making behavior despite being ethically committed while continuing to profess the same principles without incurring any blame or guilt or feeling compelled to provide any kind of reparation (Bandura, 2007, White, Bandura, & Bero, 2009). They use moral disengagement mechanisms to make their unethical conduct acceptable by convincing themselves that their questionable behavior is morally permissible. People who behave unethically are also prone to “motivated forgetting” of ethical standards – they are serial “revisionist historians”, recalling their past selectively in ways that support their decisions (Mather, Shafir & Johnson, 2000; Shu, Gino, & Bazerman 2011). They also tend to overemphasize positive features of their chosen options as compared to the negative features and have a strong motivation to bias their judgment to support their desired conclusion (Goldberg & Centers, 2012).

Figure 1: Mechanisms of moral disengagement (White, Bandura, & Bero, 2009)

Moral self-sanctions can be disengaged from wrongdoing by mechanisms of moral disengagement operating at four major loci in the self-regulatory system (White, Bandura, & Bero, 2009). Figure 1 shows how mechanisms operating at the behavior locus allow people to transform reprehensible conduct by portraying them as aimed at social and moral purposes (moral justification),

![Figure 1: Mechanisms of moral disengagement (White, Bandura, & Bero, 2009)](image-url)
Understanding Collective Moral Disengagement

by labeling their actions with euphemistic language (euphemistic labeling), or by comparing their behavior with worse and more flagrant conduct (advantageous comparison). Mechanisms operating at the agency locus allow people to obscure or to attenuate the personal relation between their actions and their consequences by considering their behavior as dictated by social pressure or by a legitimate authority (displacement of responsibility) or by diffusing their responsibility to joint action, making their individual contribution undistinguishable (diffusion of responsibility).

Mechanisms operating at the outcome locus allow people to avoid acknowledging the blameful effects of their behavior by disregarding and distorting its consequences. Finally, mechanisms at the recipient locus allow people to withdraw empathetic and sympathetic feelings for those who will suffer by considering them responsible for their condition and deserving harm and punishment (attribution of blame) or by impersonalizing and dehumanizing them (dehumanization). These mechanisms allow people to behave poorly without feeling obliged to any kind of reparation and without carrying any need to change the moral standards they are ignoring. In fact, they use these mechanisms to recode their actions so that they appear less immoral.

This theory also claims that people involved in collective decision-making situations cannot be viewed simply as socially detached, autonomous moral agents – they are also enmeshed in social systems. The social forces emanating from social groups can operate on a person in such a manner that they can provide moral exonerations for each other (Janis, 1972; White, Bandura, & Bero, 2009). Therefore at the emergent group level, people engage in groupthink and collective moral disengagement, since being part of a group neutralizes the implications of their role and obscures their personal accountability. Public managers working in state bureaucracies are especially vulnerable as superiors can use their authority with the expectation that the subordinate accepts their decisions (Beu & Buckley, 2004; Hinrichs, 2007). If these public managers feel “ordered,” they may simply displace the responsibility for their actions on their superior. While it is plausible that decision-makers sometimes rely on their biased intuitions (Sunstein, 2005), it will be argued that in this case study, group (political party) and individual interests were being advanced instead of the greater public good. In other words, as a result of social and environmental influences, decision-makers behaved irrationally and did not simply make erroneous judgments due to their unreliable intuitions. The next section details the selection of a case study that can help us explore the full range of these behaviors – behaviors that have several implications for e-skills education. Knowledge gained from such a case may provide a broadened perspective of complex technology decision-making that can be fruitfully applied in the classroom to cultivate morally engaged students.

Case Study Background: Urban Tolling Sparks Controversy

This research is conducted on one of South Africa’s most controversial government projects – the Gauteng Open Road Tolling (ORT) project. The project, initiated in 2006, has sparked a challenge from various groups in civil society and was embroiled in a lengthy legal battle. The South African National Roads Agency Limited (SANRAL), a state-owned enterprise, is primarily responsible for the financing, development, maintenance and rehabilitation of South Africa’s 16 170km national road network. Its activities include non-toll and toll operations. Toll roads are self-funding based on the user-pays principle. SANRAL has used two types of tolling: traditional toll collection at a toll plaza; and electronic toll collection (ETC), where either credit cards or an electronic transponder system (e-tag) identifies the vehicle and allows it to pass. Most of the conventional tolls are on newly built routes for long distance destinations, mainly found on regional roads. There has been increasing interest in private toll roads as an alternative way of meeting highway needs.
The controversial ORT project intends to use overhead gantries approximately every 10km along Gauteng’s existing urban highway system to collect toll fees electronically. The gantries are fitted with electronic readers that recognize vehicle identifiers such as e-tags or vehicle number plates – and are set to automatically deduct toll fees from a road user’s registered e-toll account. Users would be serviced by a complex of service channels including a call centre and website, e-toll kiosks and e-tag outlets at various shopping malls, and e-toll customer-service centers situated along the freeway network. SANRAL has also procured a central account management and clearing system, and established a violations processing centre as part of the operation. Not surprisingly, an independent research team hired by SANRAL’s (Graduate School of Business, 2010, p. 36) conceded that: “paying for roads through taxes or a dedicated fuel levy is simply cheaper than imposing tolls on a road even if this is through an ORT system. The cost of collection is far lower because it does not incur the cost of the toll collection system”. In this sense and assuming that the decision-makers had full access and time to reflect on this information, the decision was irrational. A rational decision would have weighed the pros and cons of alternative funding options and chose the decision that maximized overall benefits while minimizing overall costs.

Meanwhile lack of transparency and conflict of interest has also been the hallmark of the e-toll project. Public managers voiced their reluctance to share vital information. For instance SANRAL initially refused to disclose details of the Electronic Toll Collection Joint Venture: “The information requested by Opposition to Urban Tolling Alliance (OUTA) is and remains the intellectual property of third party organizations” (SAPA, 2012). SANRAL chose to partner with private entities to design and build the facilities and manage these operations. The decision to use a foreign company as the primary partner instead of stimulating the development of local technology was also questionable. Headquartered in Austria, the e-tolling and traffic solutions firm and the largest shareholder in the e-tolling consortium, reported in the 2010/11 financial year that its road solutions projects segment, under which e-tolling falls, grew 247% year-on-year (Rasool, 2012). According to the CEO: “This positive development resulted largely from electronic toll collection system implementations in SA and Poland” (Rasool, 2012). Opponents claim that the ruling party’s links to the joint venture and Government Employee Pension Fund (GEPF) holding R15.7 billion in SANRAL bonds were other reasons for the lack of transparency (Rasool, 2012). Some critics argued that these conflicts of interest were the real reason government insisted on pursuing the project, despite its unfeasibility and despite it facing public resistance (Rasool, 2012). However, given that the public service is accountable for the greater public interest, ahead of the compensation of its employees and financial opportunities for party members and party donors, it is realistic to view this behavior as both unethical and irrational.

Not surprisingly, a cross-section of society, including Gauteng residents, business, trade unions, civil society groups, a few opposition party politicians and senior government officials such as the Deputy Minister for Transport voiced strong opposition to the ORT project. Drive-slow demonstrations and other civil disobedience protests were held to voice opposition to tolling. There is a general consensus among Gauteng residents that e-tolling was a bad decision and will result in harm. Despite pressure from SANRAL and the state, reports suggested that only 350 000 out of an estimated four million registered vehicles in Gauteng had registered to pay e-tolls (OUTA, 2012). In late 2011, the opposition groups formed an alliance to legally challenge the project. The Opposition to Urban Tolling Alliance (OUTA) received over R5 million in financial support from business and citizens around the country to cover their legal costs (OUTA, 2012). On 29 April 2012, just two days prior to the official launch, the High Court granted the interdict sought by opposition groups to halt the commencement of tolling pending a full review of the e-tolling records and decisions.
Case Study Approach

This study adopts a qualitative case study approach because it has the advantage of enabling the examination of the rich social, political and economic influences on public sector technology decisions. The Gauteng ORT project requires scholarly analysis because it represents large-scale technology initiatives that involve complex arrangements among civic participation, inter-governmental collaboration and public-private partnerships. Yin (2008) endorses a single case approach, explaining that it can often produce a more in-depth study and consequently greater insight. The case study approach and the use of the selected theoretical framework allowed the researcher to make an informed analysis of the case. The intention was not to generalize the findings to a wide range of government technology decisions (Ruddin, 2006). Instead the goal was to perform an analytical generalization – that is, to generalize a particular set of results to the study’s theoretical propositions about moral disengagement. Four criteria were used to ensure the scientific rigor of this study (Guba & Lincoln, 1985): confirmability (use of standard coding protocol), credibility (minimizing bias and improving the neutrality of the results by establishing a match between the different codes, by using content obtained from multiple sources, by employing an academic blind to this study to check the research design, all provided reasonable verification of the accuracy of the coding procedure), triangulation (assessing the degree of similarity of the viewpoints between the different decision-makers, e.g. Finance Ministry and Transport Ministry) and dependability (reliability, accuracy and consistency of the data were achieved by resorting to public records, which reflect the candid view of the person) and by creating an audit trail of documents (Darke, Shanks, & Broadbent, 1998).

The study of moral transgressions in technology and related decision-making is not easily examinable using conventional research approaches. Researchers tend to rely on scandals, the media, public enquiries, police investigations, whistleblowers and legal battles to get a momentary peek into the ‘cloaked’ world of public managers and their involvement in morally dubious activities (Bandura, Caprara, & Zsolnai, 2000). A number of documents and records supplied by SANRAL, OUTA, the National Treasury and the Department of Transport to the High Court, now publicly available, provided insight into how decision-makers justified their actions. Consequently, published secondary sources become a pivotal source of data for the researcher. Over 60 documents were analyzed, including publicly available copies of affidavits, court transcripts, letters, internal memos, internal planning documents, correspondence, public statements, press releases and newspaper articles. Sources included public sector officials, executives, lawyers, public relations experts, contracted researchers and consultants. Public managers also used television and radio interviews as strategic tools in the social management of moral disengagement to present a different perspective from the opposing groups. Some of these transcripts were also examined for moral disengagement mechanisms.

Documents were coded for the pre-defined categories of moral disengagement described in Table 1. These coding modes of moral disengagement served as the guide for the coding procedure (Bandura, Barbaranelli, Caprara & Pastorelli, 1996; Fereday & Muir-Cochrane, 2006). It includes formal definitions of each of the mechanisms and examples representing the different ways in which moral disengagement is manifested. The author independently coded the content and achieved consensus with an assistant researcher in the case of any discrepancies. Another academic blind to the purpose of the study acting as an independent judge, coded 20 randomly chosen excerpts, assigning 18 of them to the same categories as the author, yielding a 90% level of agreement. Seventy examples of moral disengagement were observed in the documents and entered into a database. Examples were selected for each moral disengagement category based on the following: (1) the example is unambiguous as an indicator of moral disengagement; (2) it is representative of a number of statements in the dataset; (3) it reflects an important development in the response of public managers with regard to the impact of their decision. The most illustrative
of these were included in this article. The sources of the 70 statements were categorized by the functional role of the personnel (examples: Minister, Director General, consultant, executive, lawyer, researcher or public relations expert). Version 5 of ATLAS.ti was used to code and store the categories and themes.

## Results and Discussion

All eight different moral disengagement mechanisms were evident in the Gauteng ORT case (see Table 1). The sections that follow document how each of the mechanisms of moral disengagement were enlisted by the actors.

### Table 1: Modes and Examples of Moral Disengagement

<table>
<thead>
<tr>
<th>MODES OF MORAL DISENGAGEMENT</th>
<th>DEFINITION INCLUDING KEY THEMES</th>
<th>EXAMPLES FROM THE CASE DOCUMENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Moral justification</td>
<td>The use of moral explanations to justify harmful decisions and to challenge rational decision-making norms. Harmful decisions are regarded as serving worthy purposes and actors reward themselves for performance.</td>
<td>“I know what the value of my time is. SANRAL, as far as I am concerned, should get a medal for what they have done in terms of time saving (Sankaree &amp; Botha, 2012).”</td>
</tr>
<tr>
<td>Euphemistic labeling</td>
<td>The use of sanitizing and convoluted language to make harmful decisions personally and socially acceptable.</td>
<td>“The current ‘free at the point of use’ system comes at a very high economic cost. ‘Free’ roads breed congestion; ‘free’ roads slow up freight delivery, ‘free’ roads get people to work late; ‘free’ roads reduce economic growth, and they slow employment creation (SANRAL, 2012a, p.182).”</td>
</tr>
<tr>
<td>Advantageous comparison</td>
<td>Comparing or contrasting harmful decisions to actions that make them appear benign, of little consequence, or of lesser negative effect.</td>
<td>“I must state that tolling remains one of the most viable means of funding transport infrastructure all over the world. Many countries – developing and developed – including China, the United Kingdom, the United States of America, use tolling to raise funds for the construction of much-needed transport infrastructure (South African Government Online, 2011).”</td>
</tr>
<tr>
<td>Displacement of responsibility</td>
<td>Absolving the individual or group of personal responsibility for harmful decisions by viewing it as being ordered by others, and by creating systems of deniability that keep actors intentionally uninformed.</td>
<td>“The reinstatement of a “dedicated fuel fund” is debated and demanded by many….The draft RISFSA initially proposed that this funding mechanism be reintroduced however National Treasury was not in support of the proposal. The DOT has indicated that it will investigate this matter further with the intention of tabling it again at a later stage (SANRAL, 2012a, p. 99).”</td>
</tr>
<tr>
<td>Diffusion of responsibility</td>
<td>Absolving the individual of personal responsibility for harmful decisions by giving responsibility to the group and various facets of decision-making to sub-groups. In this way no one is held personally accountable for the harmful decision taken.</td>
<td>“Two auditing firms namely Deloitte and PWC were appointed to review the SANRAL financial model. Deloitte reviewed the inputs to the SANRAL Cost Model and the overall results presented. PWC reviewed the formulae and outputs of SANRAL Cost Model, and the inputs, formulae and outputs of the SANRAL Revenue Model (SANRAL, 2012a, p.135).”</td>
</tr>
<tr>
<td>Disparaging, denigrating critics, and victims</td>
<td>Attributing disparaging qualities to other opponents and/or those who will suffer the consequences, accusing them of irresponsible or sinister motives.</td>
<td>“If you don’t like it, catch a taxi (Justice Project South Africa, 2011).”</td>
</tr>
<tr>
<td>Attribution of blame</td>
<td>Blaming the victims for bringing harm to themselves by their behavior and blaming dissidents for bringing harm to the economy. Other circumstances such as external conditions are also blamed for harmful effects.</td>
<td>“This situation is caused by a combination of factors including the marginalization and under-use of public transport within the province (SANRAL, 2012b, p. 77).”</td>
</tr>
</tbody>
</table>
Minimizing, denying, disputing or distorting consequences

Any evidence of harm by victims and dissidents are discredited.

The High Court’s intervention was “overstepping the line”, in “fundamental breach of the division of powers” and interfering in “a crucial aspect of government of policy in the form of the revenue procurement and allocation (South African Government Online, 2011).”

Adapted from: White, Bandura, & Bero, 2009

**Moral Justification**

Moral justification of the project took the form of social, economic, legal and symbolic justifications (Bandura, Caprara, & Zsolnai, 2000). These included promoting the importance of the road infrastructure to the national economy; the purported social benefits of e-tolling; protecting the integrity of the decision to use e-tolling compared with alternatives such as a fuel levy; the promotion of the free enterprise system and black economic empowerment; legal justification to protect the “intellectual property rights” of their private partners, and to symbolically project South Africa as being prepared to host the 2010 FIFA World Cup® soccer tournament. An economist for the public sector portrayed the decision to introduce e-tolling in a positive light (Sankaree & Botha, 2012): “I know what the value of my time is. SANRAL, as far as I am concerned, should get a medal for what they have done in terms of time saving”. The e-tolling system was invested with further economic justifications. In a television interview (Sankaree & Ali, 2012), the CEO of SANRAL stated that: “The studies that everybody is doing aren't showing that … we have created about 10 000 jobs and what we have been contributing to the economy of Gauteng is over R14 billion in one year”. The following excerpt from SANRAL’s business plan (OUTA, 2012, p. 38) presented to the Minister of Transport in 2005 provides evidence that the soccer world cup was used as a reason to expedite the project at the expense of legal processes: “The environmental process will be a major stumbling block, if this project needs to be completed or partially completed for the FIFA 2010 Soccer World Cup®. If some of the sections are not completed by then, there will be severe traffic congestions by 2010”.

**Advantageous Comparisons**

The legitimacy of decisions was colored by what the e-tolling project was compared against. By using comparative exoneration they freed themselves of restraint over the morality of their investment decisions, by the following examples of statements (South African Government Online, 2011): “I must state that tolling remains one of the most viable means of funding transport infrastructure all over the world. Many countries – developing and developed – including China, the United Kingdom, the United States of America, use tolling to raise funds for the construction of much-needed transport infrastructure”. Although the Minister of Transport approved tolling on the basis that users would be required to pay between 28.5% and 36% of the capital cost of the project, opposition groups calculate that road users would actually be paying 162% of the capital costs in the form of toll collection. The resulting financial consequences of this decision to road users, taken over a 20-year period, would amount to a staggering R33.4 billion in toll collection costs (OUTA, 2012a, p.76). The Minister of Finance denied that the tolling costs were disproportionate (South African Government Online, 2012): “From what we’ve been informed the cost of collection would be about 20% once the initial phases have gone through to set up machinery and so on. And by international comparison in respect of these sorts of mechanisms that’s fairly low.
So we’ve satisfied ourselves that it is within acceptable limits if you like, in terms of international experience.”

**Euphemistic Labeling**

Politicians and corporate leaders are aware that language shapes the citizenry’s perceptions and thoughts about their actions. These actions take on quite a different meaning depending on terminology used. The analysis confirms that decision-makers reduced their self-sanctions by presenting their activities in sanitized, convoluted and innocuous language. For example, the privatization of once public roads was disguised as “e-roads” and citizens were rendered new as “e-road users” or “beneficiaries”. The notion of “free roads” was viewed as a taboo; the use of roads was posed as a “benefit”, not a right paid for by taxpayers. A SANRAL report stated that (SANRAL, 2012, p.182): The current ‘free at the point of use’ system comes at a very high economic cost. ‘Free’ roads breed congestion; ‘free’ roads slow up freight delivery, ‘free’ roads get people to work late; ‘free’ roads reduce economic growth, and they slow employment creation. Banks and private investment firms are also turning once publicly owned road infrastructure into a “new asset class”; a “fixed-income proxy” which “delivers similar yield expectations to high-yield bonds and real estate, with less risk”. E-Roads have become investments that are “safe like high-grade bonds” but with “stock market-like returns”. After all, competition is limited and it is difficult to build a rival e-road. Citizens have become “captive customers” from whom “cash flows are guaranteed” (Thornton, 2007). The new traffic police are to be called “peace officers” – an oxymoron (SANRAL, 2012b). Are toll highways meant to be managed like a conflict zone? SANRAL and government appear unclear about the enforcement procedures for non-payers and how the debt collection process is to be enforced by an already backlogged judicial system. SANRAL (SANRAL, 2012b) is also seeking to legislate that “an employee in full or partial uniform” may “at any time enter any motor vehicle and inspect such vehicle and any electronic device installed therein for the purpose of toll collection”. This proposal ignores both the Criminal Procedure Act and the Constitution of the Republic of South Africa that protects the right of every citizen not to have their person, home or property (which includes a motor vehicle) searched without a warrant.

Furthermore, the marketing of the project portrays technology in morally neutralizing terms to persuade “e-road users” to get “e-tagged” at “e-toll customer service outlets”, and transform themselves into a responsible “e-toll account holder” who accepts the concept of “road pricing” (Justice Project South Africa, 2012). Citizens are being influenced by a combination of bullying tactics and psychological persuasion intended to create a desire to use the “new” e-road products. Ironically, the opposition’s reference to “e-tags” as a modern “electronic dompas” is perhaps a more fitting description of reality – the paper dompas curtailed the movement of black citizens into so called white areas during the apartheid era (SANRAL, 2012c). Tolling is arguably discriminatory in the same perverse way that the apartheid dompass system was. Like its apartheid predecessor, this new technology segregates the road systems by affordability and prevents poor citizens from accessing a basic right. From an ethical standpoint, it is arguably arbitrary whether racial differences or affordability differences are used to curtail a citizen’s basic right to free movement. Yet, public managers and their private sector partners resort to linguistic camouflage to increase their own willingness to engage in these ethically dubious activities. These sanitizing euphemisms are also intended to neutralize public perception to the harmful realities of the decisions made.

**Displacement and Diffusion of Responsibility**

Decision-makers spare themselves self-disapproving reactions by shifting responsibility to others or to situational circumstances. In this way, they absolve themselves of personal responsibility for the harm they are causing. For instance, government projects contain complex divisions of labor
in which the subdivided decision-making activities can seem harmless in themselves. People can easily divert themselves from the morality of what they are doing to the operational details and efficiency of their specific tasks. In this case, public managers absolved themselves of personal responsibility for the harm caused by their decision by viewing their activities as ordered by others and by creating systems of deniability that kept them intentionally uninformed. They shifted responsibility for their decisions to consultants, contracted researchers, and partnering organizations that served as their proxies in the decision-making process. For instance, one of the affidavits (SANRAL, 2012a, p. 135) read: “Two auditing firms namely Deloitte and PWC were appointed to review the SANRAL financial model. Deloitte reviewed the inputs to the SANRAL Cost Model and the overall results presented. PWC reviewed the formulae and outputs of SANRAL Cost Model, and the inputs, formulae and outputs of the SANRAL Revenue Model”. Furthermore, since this was a group decision, decision-makers collectively reduced their personal accountability for the harm they produced. In addition, the very structure of the state bureaucratic machinery obscured personal accountability. These insulated structural arrangements provided public managers with protection from self-criticism and spared them loss of self-respect for authorizing a morally dubious investment. For example, SANRAL held the National Treasury and the Department of Transport (DOT) responsible for not considering the use of the fuel fund to finance the development and maintenance of the roads (SANRAL, 2012a, p. 99): The reinstatement of a “dedicated fuel fund” is debated and demanded by many… The draft RISFSA initially proposed that this funding mechanism be reintroduced however National Treasury was not in support of the proposal. The DOT has indicated that it will investigate this matter further with the intention of tabling it again at a later stage”. So some public managers created schemes of deniability that left them blameless, as global effects in decision-making were seen as the cumulative products of local actions.

Disparaging, Denigrating Critics and Victims
Decision-makers related to dissidents and victims in impersonal ways. They grouped, divided, devalued, and dehumanized those not in favor of their decision. Opponents such as OUTA were disparaged for being scaremongers and destabilizing the country’s economy. Furthermore, SANRAL belittled OUTA’s actions in a press release, referring to it as nothing more than a “fund-raising exercise” (SAPA, 2012): “SANRAL remains concerned about ongoing statements made in the media about various aspects of this matter, which appear to be designed to cast doubt on the process and litigate the matter rather in a court of public opinion, as part of an ongoing fund-raising exercise.” The strength of moral self-censure depends on how those who suffer the consequences of our actions are regarded. Those who are not part of the in-group are easily removed from moral considerations when they conflict with the in-group’s interests. As a result, moral self-sanctions are disengaged or blunted by depersonalizing and stripping opposing groups of the right to be treated with respect. For instance, when faced with mounting public resistance SANRAL attempted to intimidate motorists by introducing a punitive rate – a rate that was almost 580% higher than the discounted rate – for those who did not purchase an e-tag (Justice Project South Africa, 2012a). To further intimidate motorists into complying, another public official suggested that those who do not register for e-tolling will not have their licence disc re-issued (Justice Project South Africa, 2012b):“… it would be considered in the same light as not paying your traffic fines, which was a cause for disallowing the renewal of a vehicle licence”. The Minister of Transport was reported to have said: “If you don’t like it, catch a taxi” (Justice Project South Africa, 2011). A protester stated: “This must send a message to government that they should not treat us like subjects but like human beings who brought them into office” (Sankaree & Mseleku, 2012).
**Disregarding, Minimizing and Disputing**

Public managers also avoided facing up to the harm they cause through their decisions by disregarding, minimizing or disputing the naysayers. The public documents revealed that they provided contradictory evidence to challenge their opponents. They also attempted to trivialize the impact of their decisions, thus neutralizing any moral concerns. Another common tactic used for neutralizing moral concern was the derogating and discrediting of opposition groups as misguided crusaders. The following comment by the Minister of Finance attempted to minimize the harmful economic effects to frequent travelers using these urban routes, arguing that the opposition groups were putting out inflated numbers to the public (Bizcommunity.com, 2012): “…statistics derived from the gantries on the highway showed that people would not be paying more, on average, than R100 to R150 a month”. Some opposition groups (Justice Project South Africa, 2012b) argue that apart from negatively influencing the wallets of lower-income motorists, e-tolls will effectively redistribute a once public service by income class. Yet, according to Ngoepe (2012), a Treasury official argued that their study showed that the poor would not be affected in using the vital public facility because the poor used public transport. “We have done a study on the people who use the highway and we are certain that we are not touching the poor. People who use public transport are the poor”. Meanwhile OUTA’s contentions of harm were viewed as “inaccurate and exaggerated”, as having “no basis” and as being “misconceived” (Gordhan, 2012). OUTA’s estimates of e-tolling costs were also viewed as “simplistic and patently incorrect figures” (Ali, 2012). Senior public officials dismissed the High Court’s intervention in granting the interdict that tolling should not commence, arguing that the court was “overstepping the line”, in “fundamental breach of the division of powers” and interfering in “a crucial aspect of government of policy in the form of the revenue procurement and allocation” (South African Government Online, 2012).

**Attribution of Blame**

The e-tolling project was initially conceived to be delivered within a broader context of an integrated public transport system and improvements to non-toll alternative routes. The opposition groups argue that SANRAL and the Minister of Transport failed to consider their own social impact assessment, which assumes that an integrated transport plan and viable alternative routes exist before e-tolling may commence. Instead of SANRAL and the Minister answering these charges, they blamed people who are adversely affected for their position. Adverse effects were ascribed to the personal choice of citizens for their “ineffective use of private transport” or the poor use of the beleaguered public transport system, or were displaced to other factors such as environmental concerns (SANRAL, 2012a, p.130). A SANRAL report stated (SANRAL, 2012a, p.77): “This situation is caused by a combination of factors including the marginalization and under-use of public transport within the province…the increasing use and reliance on private cars within a context of historically sub-optimal public transport systems and the spill-over effects of a failing rail system that has suffered years of under-investment and poor service quality.” The same document stated that “the private car and freight car users should be paying a greater portion of the real costs of using the road network” (SANRAL, 2012a. p.87).

**Moral Engagement**

At times, some public managers expressed reservations or concerns about the project. A prominent trade union leader whose union played a leading role in the protests – despite reportedly making a significant profit from the road infrastructure portion of the project – framed the pricing of existing urban routes as a form of economic apartheid (Vavi, 2012): “The logic of those that say that the poor do not use the motorways, except by public transport, is that they should be permanently excluded from access to the best roads. They must find the pot-holed side roads to get from point A to point B, while the rich glide along in their fancy cars on these highways. Tell
me about economic apartheid, again.” The CEO of SANRAL acknowledged that “the economic benefits would have been even higher if they were to be funded in part or wholly from the National Treasury”, because “tolling reduces user benefits by the cost of the tolling infrastructure” (OUTA, 2012, p.56). The previous Minister of Transport also expressed doubts about the benefits of e-tolling in response to a question on the scheme’s efficiency raised in parliament (COSATU, 2012). These individuals at times adhered to moral standards. However, they also succumbed to strong social pressures and consequently compromised their standards by allowing the project to continue, without taking reasonable steps to address their concerns about the public good.

### Discussion

The findings support the applicability of moral disengagement concepts in a controversial technology decision-making context (Bandura, 1990, 1991). The case study demonstrates that public managers are vulnerable to resorting to systematic and collective moral disengagement strategies to justify projects that are morally and rationally dubious. The results show various instances where senior public managers morally exonerated their decision: by endowing it with socially worthy purposes; euphemistic labeling; displacing and diffusing responsibility; downplaying negative consequences; making favorable comparisons; and disparaging and blaming opposing groups (White, Bandura, & Bero, 2009). Given that all eight moral disengagement psychological devices were used for in this case, society cannot rely solely on public managers – however righteous their personal standards may appear to be – to make ethically sensitive economic and social development decisions. While professional bodies insist that their members apply the highest ethical and professional conduct when assessing the impact of technology decisions on the welfare of the public – this study suggests that despite the existence of these principles – public managers are not mindful of these principles. Instead, when their decisions are challenged, they may resort to irrational actions such as rhetorical manipulations and unwarranted rationalizations to justify their decisions.

It is recommended that more safeguards be built into our social systems that regulate the role of the state and the private sector and their use of technologies. e-Skill educators whose current educational perspectives follow an overly amoral pedagogical approach are at risk of being part of the social environment that is complicit in legitimizing dubious e-skill practices, if they fail to acknowledge the importance of moral disengagement in their classrooms (Ghoshal, 2005). The state must also not be allowed to collude with the private sector and multinationals to unfairly or unreasonably get in the way of citizens accessing basic public services. Ethical guidelines should also encourage diversity of opinions by genuinely involving a broad set of stakeholders. Leaders in the public service should develop the self-awareness and humility to detect when their egocentric thinking is impeding them from deliberating over the rights of others. Public managers as a collective should genuinely value the role of dissenting voices (Sunstein, 2003) from both the citizenry and the business sector and pay particular attention to these stakeholders to avoid groupthink (Goldberg & Centers, 2012). Strong external experts that are largely neutral should also be used to assist with moral/ethical aspects of decision-making. Public managers should also use independent researchers rather than contract research for potentially controversial policy decisions. They should also be more transparent about the details of the project, and citizens and other opposition groups must continue to insist on high standards of disclosure. However, operationalizing these measures will remain a challenge if moral engagement is not systematically encouraged in a decision-making body and the natural susceptibility to moral disengagement is not openly acknowledged by these bodies.

This study offers two major guidelines for e-skill educators. The first major guideline proposes that educators create and nurture a classroom environment where students are urged to voice their ethical concerns. This can be achieved by openly conveying and reiterating that e-skill practices
are not free from moral and ethical dilemmas and by challenging students to examine their personal egocentric tendencies. Second, group activities should be used to demonstrate to students how naturally and quickly a group’s egocentric tendencies can emerge to thwart ethical considerations. The negative influence of egocentric tendencies can be minimized by instilling open communication among group members, and by engaging students to explore moral problem or opportunities that may exist in an e-skill practice by directing sensitivity towards the welfare of others – especially absent others like citizens. Students should also be taught to value the role of dissenting voices within their group and pay attention to these members to minimize potentially harmful groupthink. This type of moral engagement in the classroom may influence students to value a diversity of opinions – by learning to appropriately involve a broad set of stakeholder representations in real world e-skill decisions.

Conclusions

Educational researchers and policymakers should pursue the irrational tendencies that often elude us in order to assist educators and students to address the ethical implications of complex technology decisions. We need more case studies that critically analyze technology projects and the systemic influences that shape the form and level of moral disengagement in these arrangements. The academy and professional bodies should also be cautious of overselling technology at the expense of deeper intellectual debate over the way in which they can advance or weaken equity, fairness and social justice as opposed to uncritically spreading a pervasive technology discourse lured by economic spin. One thing is for certain, there will be an ongoing need to conduct quality research on moral issues in complex technology projects in order to improve ethical decision-making and the teaching thereof.

Finally, we cannot rely on amoral educational approaches to safeguard us from moral and ethical concerns with complex technology projects. If students are to be responsible stewards of public resources, our academic institutions and classrooms must “toughen” them so that they engage their moral sanctions when making decisions – decisions that support our hopes for using technology to make a better world. We need to focus our efforts on moral engagement in the e-skills classroom for sounder social and economic development decisions and the creation of a more rational society.

References


Understanding Collective Moral Disengagement


**Biography**

**Rennie Naidoo** is a Senior Lecturer (Informatics) at the University of Pretoria. Prior to embarking on an academic career, Rennie spent 15 years working in a number of management and consulting positions. He currently teaches IT project management, ERP, and special topics in research methods. He researches key issues in IT project implementation, IS use, IS decision making and IS education challenges.
An Investigation of the Choices Taken By Students with National Senior Certificate (Matric) in Enrolling for NC (V) or Report 191 at TVET Colleges: A Discussion Case Study of King Sabata Dalindyebo (KSD) TVET College as an Analogy

[Discussion Case – Abstract Only]

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Abstract

The need and lack of relevant skills in South Africa became a topic of concern. Government identified the Technical and Vocational Education and Training (TVET) Colleges as part of the solution in addressing the skills gap in South Africa. For this reason entry requirements (pre-requisites) for the NC (V) programmes were lowered to Grade 10, compared to the ones for Report 191 programmes which needed students who have passed Grade 12.

The introduction of the same TVET programmes at different levels has caused confusion to communities and students enrolling for these programmes. The problems addressed in this discussion case are challenges informing the choices taken by students in enrolling for NC (V) or Report 191 programmes. A qualitative approach was adopted to handle interviews with students and staff of a sample TVET College while a thematic approach was used to analyse and present findings from data collected through interviews.

Results confirmed the confusion. The findings are relevant for a discussion case because they can be considered as discussion topics by decision makers on possible choices for enrolling in TVET colleges and in establishing marketing and awareness programs of the TVET programmes.

Keywords: Students’ choices, NC (V) programme, Report 191 programme, TVET, case study, discussion case
Towards Building an Indigenous Knowledge Platform to Enable Culturally-Sensitive Education Underpinned by Technological Pedagogical and Content Knowledge (TPACK)

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Abstract

The everyday use of Information and Communication Technologies (ICTs) is ingrained to the fabric of today’s society. A question open for debate is whether this use is or can be optimized to engender authentic solutions, which are aligned to the natural environment of the people? In this paper, we examine at the question from the vantage point of educating the rural African child. We engage with the sub-question: can ICTs facilitate education grounded in people's own realities, especially those of the marginalized rural poor? We believe this is possible under specific conditions, which include making Indigenous Knowledge (IK) readily available. We propose building an ICT platform that allows injection of IK into the education process: develop a solution that valorizes IK, but also supports efforts to use ICTs in education driven by Technology, Pedagogy, and Content Knowledge (TPACK) framework. The main goal of this framework is to facilitate effective teaching with technology. TPACK partially embeds IK within pedagogical knowledge and ‘contexts’ of learning; we argue for explicit inclusion of IK within the framework to complement the other knowledges.

Keywords: Education, Indigenous Knowledge, Siyakhula Living Lab, TPACK

Introduction

The use of Information and Communication Technologies (ICTs) is tightly interwoven into everyday life. With growing fields like ICT4D, we no longer dispute the potential of ICTs in realizing developmental goals; ICT4D actually refers to opportunities afforded by the use of ICTs as agents of development (Sutinen & Tedre, 2010). One question that remains open for debate is whether this use is or can be optimized to engender authentic solutions, which are aligned to the natural environments of the people? This
question is broad and subject to multiple interpretations.

We turn, narrow and re-frame the question by asking whether ICTs can facilitate education grounded in people's own realities, especially those who come from marginalized backgrounds like the rural poor? We ask this question motivated by a well-established link between education and development: a telling indicator that we need quality education in order for people to have genuine agency, which allows them to participate proactively in development. We placed emphasis on people's own realities because we believe the usefulness of education to development is intrinsically dependent on being critically aware of the immediate environment. Otherwise, how can individuals be fully activated into using their agency to improve their condition? Indigenous Knowledge (IK) embodies knowledge on the immediate environment.

IK refers to knowledge that is specific to a particular place or locality (i.e., geographic area). This knowledge has a number of distinguishing features, to mention but two: 1) it is tacit in nature, and therefore, not easy to explicate or codify; and 2) it is transmitted orally or through observation and imitation (Woytek et al., 1998). These marked features of IK have contributed to its marginalization. But IK theorists like Agrawal (1995) remind us that to view IK as distinctively different from other knowledge forms (i.e. Western/scientific knowledge) is potentially absurd. What is fundamentally important is to see IK as a knowledge form that can, for example, amplify the voice of the marginalized poor in development (Agrawal, 1995).

The tacit nature of IK acts as barrier to its use. Given this, our goal is to contribute to efforts towards codifying this knowledge such that its value may be realized. We propose to develop an ICT platform that will enable IK suitable for the educational context to be captured, organized, stored and disseminated.

To populate our platform, we hope to engage community members. This naturally begs a number of questions. First, why would the members of the community opt to preserve their knowledge using ICTs? — presumably given that they had managed to perform this task for years without them. Second, to populate the platform, how do we get and sustain the interest of community members, if our platform is predominately for educational use?

By employing the Living Lab research concept, we hope to find answers to these questions. This concept advocates for community members (i.e., users) to be involved as innovators and co-creators in the entire process of service and/or product development (Schumacher & Feurstein, 2006). While we acknowledge that gaining community participation may be a challenge, we think, in our case, this will not be much of a problem; since we are working under an established Living Lab project — Siyakhula Living Lab (SLL).

In SLL, schools are used as points of presence i.e. sites for allowing community members to gain internet access. This means our enquiries are carried under a context where communities are already coupled to schools. We believe this makes it easier to engage with community members about how the absence of IK erases them (and their children) out of the knowledge economy; therefore, why it may be to our mutual interest to forge a partnership that would allow IK to be preserved and valorized.

This paper puts into context the rationale for building our platform. We posit that working together with the communities (under SLL) to avail IK to the education process will contribute positively to other efforts aimed at improving teaching and learning outcomes in a country such as South Africa. We specifically argue that the availability of IK via the use of ICTs aids efforts towards adopting a framework like Technological Pedagogical and Content Knowledge (TPACK).

According to Mishra and Koehler (2008a), TPACK is “a way of thinking about the knowledge teachers need to understand to integrate technology effectively in their classrooms” (p. 1). Undoubtedly, this thinking is aligned to how learning and teaching should be envisioned within the
digital knowledge society. However, given the inequalities that remain within our societies, we argue that TPACK has to be augmented to include IK.

In its current form, the framework embeds this knowledge within ‘contexts’ of learning, and more specifically under pedagogical knowledge. For us, this is problematic in that it perpetuates the hegemony of western thinking — creating a disconnection that we link to the failure to ultimately have endogenous development. Basically, we believe IK has to be explicated to minimize alienation of the inculcated world view of (African) learners, for as Ntuli (1999) has suggested:

The failure of our education system to acknowledge the received world views of our students has resulted in our students’ alienation from both their backgrounds and the new world into which they are socialised (p. 197).

Research Context

As we have already stated, our end goal is to develop a platform that will allow indigenous knowledge relevant to the education context to be acquired, stored, preserved and disseminated. This effectively positions our work, as depicted in Figure 1, within the confines of two other domains: education and indigenous knowledge management.

Education, in contrast to indigenous knowledge management, is a huge field with many specialties, areas of concern and multiple (often competing) theories and perspectives. In our work, we restrict ourselves, as much as possible, to an area that focuses on advancing the educational goals of the marginalized communities. We use the following questions as a guide to shaping and framing our scope:

- how can IK be used within formal education settings to bring about endogenous thinking (i.e. thinking that will inspire an inherently introverted approach in seeking solutions)?
- how best to cultivate IK from the memories of its holders such that it can be readily available?
- what counts as important IK for use in teaching and learning?
- what sociological aspects of knowledge have to be captured in order to make the dissemination of IK effective?

It should be emphasized that these questions are not new. Asking them anew merely serves to steer our work towards finding answers (and more questions) that may be relevant to our context. In pursuit of these answers, we follow an iterative and experimental approach based on the Living Lab research concept.

TPACK in Brief

TPACK (sometimes written as TPCK) is an augmentation of the Pedagogical Content Knowledge (PCK) framework proposed by Shulman (1986) to facilitate knowledge growth in teaching. As Mishra and Koehler (2006) put it: “[TPACK] is a conceptual framework for educational technol-
ogy [built] on Shulman’s formulation of ‘pedagogical content knowledge’ and extend[ed] to the phenomenon of teachers integrating technology into their pedagogy” (p. 1017).

Shulman (1986) defined PCK as a category of content knowledge that extends “beyond knowledge of subject matter ... [in order to capture a] ... particular form of content knowledge that embodies aspects of content most germane to its teachability” (p. 9). He adds that for the subject matter to be truly understandable to others, PCK necessarily has to include “the most useful forms of representation of [key ideas of taught topics], the most powerful analogies, illustrations, examples, explanations, and demonstrations” (p. 9).

In sum, from Shulman's work we can conceptualize PCK as an intersection of Pedagogical Knowledge (PK) and Content Knowledge (CK) such that we have a form of knowledge that is mostly strategic in nature; this form of knowledge blends together:

- subject matter content knowledge;
- knowledge of students’ background — with particular emphasis on conceptions and misconceptions that may cause to be learning easy or difficult;
- curricula knowledge — with scope extending beyond what may be covered outside a specific subject area including knowledge of alternative curriculum materials; and
- general pedagogical knowledge.

Shulman provided his framework at a time when only a few individuals, like Seymour Papert (2013), had asserted their optimism about the potential of ICTs (or more accurately computers) in learning. Thus, it is understandable that his work may be critiqued for lacking the technology dimension, which is incorporated into the TPACK framework, as depicted in Figure 2.

As seen from this figure, Technological Knowledge (TK) intersects with PCK to create TPACK. Akin to PCK, TPACK is a strategic knowledge form. The key difference is that TPACK accentuates the importance of technology in teaching and learning. Hence the description of TPACK as a framework that:

- encompasses understanding [of varied] representations of concepts using technologies; pedagogical techniques that apply technologies in constructive ways to teach content in differentiated ways according to students’ learning needs; knowledge of what makes concepts difficult or easy to learn and how technology can help redress conceptual challenges; knowledge of students’ prior content-related understanding and epistemological assumptions; and knowledge of how technologies can be used to build on existing understanding to develop new epistemologies or strengthen old ones. (Koehler & Mishra, 2008a, p. 3)
From the above description, there is a danger of interpreting the term ‘technology’ as a synonym for ICT. Angeli and Valanides (2009) argue, for example, that this reflects a lack of theoretical clarity, which is essential for using the TPACK framework effectively. They provide this clarity and in so doing, they introduce a strand of TPACK, which they call ICT-TPCK. Our work is technically rooted in this strand of TPACK; however, we prefer use of ‘technology’ as the encompassing term for all possible tools that act as aids to the learning and teaching process.

**Education Landscape**

In this section, we will attempt to give some context to our work. As already alluded to, navigating the education space demands sensitivity to issues that impact the goal of teaching and learning. We will have a cursory look at some of these issues.

A disciplinary field like Sociology of Education details the complexity of these issues which define the educational landscape. Figure 3 provides a glimpse of some of these issues. The figure shows that culture, language, learners’ background, curriculum theory, etc. interact with each other in various ways. These interactions may impact negatively or positively on the educational outcomes, precisely because they create connections to knowledge in a manner that draws in the social, economic, cultural and political dynamics.

With Figure 3 in mind, we will describe briefly the education system in South Africa. Next, we will present arguments for the valorisation of IK in education.

**Education in South Africa: The Big Picture**

Over the last decade or so — notwithstanding the historical legacies — the articulation of the South African education system being divided into two by privilege has amplified. Spaull (2012) provides us with a framework, depicted in Figure 4 that explains this phenomenon and how it reinforces existing inequalities in society. (Because the “digital divide” mimics structural inequalities, this framework is also conceptually useful for understanding this divide in the South African context.)

As shown in the figure, schooling is closely tied to the labour market: low quality schooling often leads to no jobs or low paying and low productivity jobs; while high quality schooling often leads to high paying and high productivity jobs. This ‘picture’ represents what is well known and documented in South Africa and other parts of the world. In the case of South Africa, Marais (2011), for example, paints this ‘picture’ of a “two-tier school system” as follows:

One part of the system is comparatively multiracial and dispenses an education of reasonable quality that can serve as a launch pad for successful tertiary education. A small
minority of learners benefit from it. The other part provides substandard education and, especially in the case of many rural and township schools, does little more than produce ‘warehouse’ learners. African schools in townships and rural areas tend to be worst performing ones; those that excel tend to be in (formerly white) affluent neighbourhoods. (p. 324)

In addition to providing an understanding of the big picture of the South African education system(s), both Marais (2011) and Spaull (2012) comment about one area which relates to our work: teachers’ knowledge. Spaull (2012) in particular reminds us that “teachers cannot teach what they do not know”. This is pertinent because TPACK, at its core, is about cultivating and growing knowledge of teachers.

**Why Emphasise Indigenous Knowledge in Education?**

The simple reason to emphasise IK in education is because it provides recognition of the world inculcated by learners. That is, IK provides background knowledge of learners. From a formal schooling perspective, this type of knowledge is deemed without (much) contention as essential for grounding and contextualising learning. This is confirmed in many works, which explicitly suggest that IK provides a good starting point for establishing context required to get learners from the ‘known’ to the ‘unknown’—see for example (Dalvit et al., 2008, United Nations Educational, Scientific and Cultural Organization (UNESCO), n.d.).

A key issue is that IK is often not seen as background or prior knowledge that can be used in engaging with learners. As aptly stated by Dalvit, Murray and Terzoli (2008), “in the post-colonial
African context, local indigenous knowledge is attributed low status and excluded from formal education, disempowering African students educationally and ideologically, by devaluing their knowledge and entrenching Western epistemological hegemony” (p. 293).

Valuing IK is therefore an imperative for empowering learners in their education to become critical endogenous thinkers. Otherwise, their education will rival in frivolity the infamous Marie-Antoinette misquotation, ‘let them eat cake’.

Our work contributes to efforts to valorise IK, specifically the African variety. In building an ICT based IK platform suited for the formal educational context, we hope as well to create a platform that will engage with some of the critical questions that have long been asked by scholars and interested parties in education. For example, Mphahlele, an educationalist and a writer of note asked the following questions, quoted verbatim from (Mphahlele, 1997):

- Can primary and secondary school teachers be inspired to rewrite folktales, myths, praise and heroic songs, proverbs, lyrics or work songs past and present in various languages, inexpensively reproduced, for use at all levels from Grade 1?
- Are we willing to acknowledge that for high school, prescribing Shakespeare is overstretching the canon? There has got to be something better for this age group in prose and poetry. If we need to make allowance for those students who feel equal to a Shakespeare play, then extra titles have to be prescribed to widen the choice for pupils who cannot deal with Elizabethan drama.
- Are we willing to confront and resolve the dramatic transformation of the culture of literacy and independent enquiry to a consumerist culture that rides on the wings of the media, especially television and print?

I-TPACK: Enhanced to Promote Culture Sensitivity

One key point that Shulman (1986) makes about PCK is that this knowledge:

also includes an understanding of what makes the learning of specific topics easy or difficult: the conceptions and preconceptions that students of different ages and backgrounds bring with them to the learning of those most frequently taught topics and lessons (p. 9).

Embedded in this statement is the role played by IK as background knowledge. TPACK embeds this knowledge in a similar way; but also crafts it into ‘contexts’ of teaching and learning, which as shown in Figure 2 act as a demarcation of all knowledges contained within TPACK.

We believe framing of IK within ‘contexts’ has the danger of rendering this knowledge invisible. Alternatively put, we believe in some contexts, it is crucial to explicate the role IK plays as a means to minimising the disconnect between the ‘lived’ knowledge and one embedded within the schooling curricula — that is, if at all we accept that multicultural education has to necessarily value the learners’ inculcated world.

We posit that the African rural space is one apt example of a context where the role of IK has to be stressed in both teaching and learning. Thus, we argue that a framework like TPACK has to be augmented for such a context: by making visible the contribution of IK in bridging a divide that potentially serves to devalue a learner’s own sense of being or culture. We hold that this will discourage (unnecessary) rote learning that stems from using an alien frame of reference in teaching — which in paraphrasing Marais (2011), produces ‘warehouse’ learners instead of critical learners that will eventually contribute (in a significant way) to endogenous development.
Culturally Sensitive Education with I-TPACK

Figure 5 captures our amended TPACK framework, which we call I-TPACK (pronounced as ee-TPACK). Introducing IK to TPACK as shown in the figure also brings to the fore other knowledge forms that need to be well understood in order to make I-TPACK functional. To bring this clarity, further research is required to understand how I-TPACK may be cultivated from its constituting knowledge forms. It is, however, important to stress that the ultimate goal of I-TPACK is to promote transformative teaching in a secure digital environment that maintains as near normal living patterns as possible with the view to:

- minimise potential ‘cultural disconnects’ brought by the devaluing of IK.
- encourage learning that emphasises inward (i.e. endogenous) thinking.
- create positive synergies between IK and western knowledge systems.

To briefly explain the rationale behind the name I-TPACK. We decided to mimic isiXhosa, a language which characteristically uses ‘i’ (pronounced as ee) to prefix nouns derived from other languages. Here the intention was to convey our awareness on the importance played by language in transformative teaching and learning.

One particular transformative learning program comes to mind, which may help to explain our point; the program is called Takalani Sesame — adapted from an “internationally acclaimed children's educational media program, Sesame Street” (Sesame Workshop, n.d.). Takalani Sesame does a marvellous job in delivering educational content to many learners in their mother tongue language, except sometimes the translations discount the learners’ own realities. This could well be that the lack of IK makes translation of ‘Goldilocks’ a norm in which the following question may be regarded easy after the narration of the story: “kutheni igama lakhe nele Goldilocks?” — why is her name Goldilocks? Learners may indeed get the answer right, but without necessarily...

Figure 5: I-TPACK
making the visual connection. (For example, anecdotally it is accepted in the environment we work in, that learners may be late the mornings Mama Mgcina — Dr. Gcina Mhlophe, a renowned South African storyteller — is telling her stories on television; precisely because of their cultural connection to ‘orality’).

Imbued by the spirit of our naming, we hope I-TPACK will, to borrow the words of Zembylas (2009), inspire modification of “curriculum and pedagogical practices in ways that promote positive experiences for all students” (p. 24). (In a manner of speaking, we hope the framework in conjunction with other efforts will yield the ‘Goldilocks effect’ in education: the ‘right’ balance between various factors that impact the educational outcomes.)

**Conclusion**

This paper presented one dimension of why an ICT based platform is required for harvesting everyday IK relevant for the education context. As we argued in the paper, this is to facilitate use of a framework like I-TPACK, which can potentially help to improve the educational outcomes of learners from marginalized backgrounds.

We acknowledge that it will take years for I-TPACK to take root within our education system. Still, we believe with sustained efforts and commitment to endogenous development, we can reap rewards from adopting and adapting I-TPACK as framework for promoting effective learning and teaching within a ‘radically transforming’ space of ICTs, while also promoting mutual understanding for a symbiotic multicultural society.

**References**


**Biography**

**Mathe Kuena Victoria Ntšekhe** is the daughter of a mother from Lesotho and a father from Botswana. She regards Africa, without any boundaries, to be her home. Mathe has a BSc in Computer Science from the National University of Lesotho, where she was also taught for a number of years. In 2007, Mathe graduated from Rhodes University with a BSc (Hons) degree in Computer Science and in 2010 an MSc in Computer Science with a distinction. She began her PhD studies at Rhodes in 2011. One of her main interests is in education.

**Alfredo Terzoli** is a Professor of Computer Science at Rhodes University, where he heads the Telkom Centre of Excellence in Distributed Multimedia. He is also Research Director of the Telkom Centre of Excellence in ICT for Development at the University of Fort Hare. His main areas of academic interest are converged telecommunication networks and ICT for development.

**Mamello Thinyane** is a professor in the department of Computer Science at the University of Fort Hare (UFH); he is based at the Alice campus. Mamello is particularly interested in how information and communication technologies (ICTs) can be used to address socio-economic challenges.
Introducing U-Learning with E-Learning into the Teaching and Learning Environment of FET Colleges

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Abstract

In recent years, the educational system has undergone changes and experienced challenges due to the introduction of Information Communication Technology (ICT) in teaching and learning methodology. Traditional methods of learning are gradually giving way to electronic learning (e-learning). The concept of e-learning has been with us in South Africa for some time now, but it has not yet been successfully implemented due largely to the problem of low bandwidth in terms of internet connectivity.

Keywords: e-learning, u-learning, South Korea, South Africa

Introduction

Many nations, particularly South Korea is currently in the lead in the adoption of U-learning, which is considered a better approach to learning because it allows for the integration of e-learning with mobile learning (u-learning=e-learning + mobile learning). In terms of infrastructural development, it is cheaper to engage in u-learning than e-learning. We cannot afford at this stage of development to lay cables to implement e-learning, followed by delays, when a new approach to the use of wireless technology is already with us.

U-learning stands for Ubiquitous learning and is a new paradigm, which ideally allows learning to take place anywhere, at any time and with anyone through the use of wireless devices like smartphones, tablets and iPads etc. Mark Weiser (1993), first proposed ubiquitous computing technology, which refers to the use of devices such as personal digital devices (PDAs), cell phones and portable computers in a physical world of learning.

E-Learning like u-learning has the potential to enhance the method of teaching and learning, but, there are certain barriers that make u-learning more satisfactory and these are discussed as follows:

a) In u-learning, students are often engaging with mobile devices outside of the classroom. They can easily be reached because they are totally immersed in a learning process.

b) It encourages/facilitates individualised methods of teaching that can help students to learn at a faster rate,
more effective and with greater understanding.

c) The technology provides real-time and all round access to information because it can be applied immediately and at any time.

d) It prepares and encourages students to become life-long learners, in that they are able to use multiple devices to access and search for information and knowledge while developing their search skills.

e) It creates a free interactive environment where they can interact with each other and with instructors and

f) Learners are able to access or receive information with their portable devices at any time and at any place, about class or school news in real time.

Comparison of U-Learning with E-Learning Systems

Table 1 depicts a comparison of u-learning with e-learning, adopted from the Pacific Journal of Science and Technology (http://www.akamajuniversity.us/PJST.htm).

<table>
<thead>
<tr>
<th>U-learning System</th>
<th>E-learning System</th>
</tr>
</thead>
<tbody>
<tr>
<td>The system can sense the learner’s environment. It is context aware.</td>
<td>The system cannot sense the learner environment. It is not context aware.</td>
</tr>
<tr>
<td>Learners can never lose their work. There is continuity.</td>
<td>Learners can lose their work. There is no continuity.</td>
</tr>
<tr>
<td>Learners have access to their information from anywhere.</td>
<td>Learners have access to their information in specific locations.</td>
</tr>
<tr>
<td>Learners interact with experts and others</td>
<td>Learners’ interaction is limited.</td>
</tr>
<tr>
<td>Learners get the right to internet at the right time</td>
<td>Learners get the available information.</td>
</tr>
</tbody>
</table>

Conclusion

The idea of introducing ubiquitous technology into the e-learning environment of FET Colleges is not that it should replace e-learning, but that it could be seen as an extension to e-learning. The reason is that our learners already own u-learning devices such as smart phones. They are totally immersed in the use of such devices which have become part of their daily life-style. More than that, u-learning is a learner-centred paradigm, with the aim to achieve learning at the right time and at the right place with right services.

In our effort to embrace u-learning, it may be of interest to know that Umfolozi College is currently taking the bold step to go into partnership with South Korea, with the primary aim of exchanging ICT programmes in the area of infrastructure and human resources. Our association with South Korea is motivated by the fact that they strongly believe that investment in human resources does not only reduce the rate of unemployment but also helps to improve the economic growth of any nation.
References


Biography

Joseph A. Okharedia is an IT & Computer Science Lecturer at Umfolozi College - RICHTEK Campus.

Joseph holds a Bsc. (Hons) degree in Geology, PGD (Computer Science), Master’s degree in Computer Science and PGC in Education.

The introduction of e-learning into the teaching and learning environment of our colleges has the potential to enhance the method of teaching and learning; that should be embraced by all institutions of learning. Joseph is of the opinion that while embarking on e-learning, the emphasis should be on U-learning (Ubiquitous learning): a new paradigm, which ideally allows learning to take place anywhere, at any time and by anyone through the use of Mobile devices like smartphones, tablets, iPads etc. Learners already own such devices and they are totally immersed in the use of such devices that have become part of their daily life-style.
Dynamic Business Intelligence and Analytical Capabilities in Organizations

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Abstract

Although Business Intelligence and analytics (BI&A) is one of the most essential technologies to be purchased, the implementation of many BI&A projects fail. They do not fulfill the expectations of organizations. The reasons for this failure are not clear and still not well investigated. Resource-based View (RBV) and dynamic capability theory could help to overcome this gap and to provide an appropriate theoretical basis for future research in BI&A area. The research objectives for this study are: (1) conceptualization and discussion on BI&A dynamic capability, (2) building the comprehensive framework of BI&A capabilities. In order to address these objectives, the remainder of the paper is structured as follows: The first sections provide the theoretical foundations of BI&A, RBV and dynamic capability theory. Next, the BI&A capability was conceptualized. Finally, a model of BI&A as a dynamic capability was proposed. The study was based mainly on (1) a critical analysis of literature and (2) interviews with managers and experts in BI&A. The results of this study can be used by IT and business leaders as they plan and develop BI&A capabilities in their organizations.

Keywords: Business Intelligence and analytics (BI&A), Resource-based View, dynamic capability

Introduction

In order to gain competitive advantage on global market, many organizations decide to use Business Intelligence and analytics (BI&A). It is believed that BI&A enables organizations to better understand not only internal business processes, but also the competitive environment through the systematic acquisition, collation, analysis, interpretation and exploitation of information. BI&A allows for the identification of the opportunities and threats, which may occur on the market, while cooperating with customers, suppliers and competitors (Chen, Chiang, & Storey, 2012; Davenport & Harris, 2007; Davenport, Harris, & Morison, 2010; Karim, 2011; Liautaud & Hammond, 2002; Moss & Atre, 2003; Negash & Gray, 2008; Wixom & Watson, 2010; Wixom, Watson, & Werner, 2011) (Figure 1).

It is worth mentioning, that in 2010, BI topped the list of the most important application and technology development in an annual survey of IT executives (Lufman & Ben-Zvit, 2010). According to Gartner research and Forrester the BI market will grow from $8,5 billion in 2008 to $12 billion in 2014 (“Gartner’s 2011 CIO survey results,” 2011).
Dynamic Business Intelligence and Analytical Capabilities in Organizations

Although BI&A is one of the most essential technologies to be purchased, the implementation of many BI&A applications fail. The organizations do not achieve the appropriate benefits (Chaudhary, 2004; Howson, 2008; Isik, Jones, & Sidorova, 2011; Schick, Frolick, & Ariyachandra, 2011; Watson & Wixom, 2007). The reasons for this failure are not clear and still not well investigated.

Resource-based View (RBV) and dynamic capability theory could help to overcome this gap and provide an appropriate theoretical basis for future research in BI&A area. This paper seeks to throw more light on the concept of BI&A by using a dynamic capabilities perspective. I consider that BI&A capabilities may be critical functionalities that help organizations to improve their performance and adapt to environmental change. The research question I ask in this paper is: what new light contribute RBV and dynamics capabilities to BI&A area. Consequently, the research objectives for this study are (1) conceptualization and discussion on BI&A dynamic capability, and (2) building a comprehensive framework of dynamic capabilities needed for BI&A.

In order to address these objectives, the remainder of the paper is structured as follows: The first sections provide the theoretical foundations of BI&A, RBV and dynamic capability theory. Next, the BI&A capability was conceptualized. Finally, a comprehensive framework of BI&A as a dynamic capability was proposed. The study was based mainly on (1) a critical analysis of literature, and (2) interviews with managers and experts in BI&A. The results of this study can be used by IT and business leaders as they plan and develop BI&A capabilities in their organizations.

**Theoretical Background**

**Business Intelligence and Analytics**

Business Intelligence and analytics (BI&A) have become the significant research area in the domain of management information systems in the last years (Chen, Chiang, & Storey, 2012). The roots of BI&A originate from decision support systems, which first emerged in the early 1970s.
when managers used computer applications to model business decisions. Over the years, other applications, such as executive information systems (EIS), online analytical processing (OLAP), data warehousing, and data mining became important (Davenport & Harris, 2007; Liautaud & Hammond, 2002; Negash & Gray, 2008; Wixom & Watson, 2010). Today BI&A is compared to "an umbrella" that is commonly used to describe the technologies, applications, and processes for gathering, storing, accessing and analyzing data to help users to make better decisions (Davenport, Harris, & Morison, 2010; Watson, 2010).

BI&A is comprised of both technical and organizational elements (Alter, 2004; Eckerson, 2005; Jourdan, Rainer, & Marshall, 2007; Olszak & Ziemba, 2004; Wells, 2008). From a technical point of view BI&A is an integrated set of tools, technologies and software products that are used to collect heterogenic data from dispersed sources and then to integrate and analyze data to make them commonly available. The key BI&A technologies include: data warehousing, data mining and OLAP (Olszak & Ziemba, 2006). They are often called BI&A 1.0. In the last years, new techniques, such as: web mining, opinion mining techniques, mobile mining techniques and semantic processing are applied in BI&A applications. Such applications, focused mainly on processing of semi-structured or un-structured data that originate from Internet and social media, are named BI&A 2.0. In turn, applications responsible for collecting and analyzing data from various mobile devices are called BI&A 3.0 (Chen, Chiang, & Storey, 2012; Olszak, 2013).

From an organizational perspective, BI&A means a holistic and sophisticated approach to cross-organizational decision support (Isik, Jones & Sidorova, 2011; Moss, & Atre, 2003). Negash and Gray (2008) argue that BI is responsible for transcription of data into information and knowledge. Also, it creates some environment for effective decision-making, business processes, strategic thinking, acting in organizations and taking the competitive advantage (Albescu, Pugna, & Parasciv, 2008; Baaras & Kemper, 2008; Chung, Chen, & Nunamaker, 2005; Olszak, 2013; Venter & Tustin, 2009). Many authors highlight that BI is predisposed to support decision-making on all levels of management (Davenport, Harris, & Morison, 2010; Herschel & Jones, 2005; McGonagle & Vella, 2002; Mos & Atre, 2003; Negash & Gray, 2008). On the strategic level, with the help of BI it is possible to set objectives precisely and follow the realization of such established objectives. BI allows for performing different comparative reports, e.g. on historical results, profitability of particular offers, effectiveness of distribution channels or forecasting future results on the basis of some assumptions. On the tactical level BI may provide some basis for decision-making within marketing, sales, finance, capital management, etc. BI allows for optimizing future actions and modifying organizational, financial or technological aspects of company performance appropriately in order to help enterprises to realize their strategic objectives more effectively. In turn, on the operational level, BI systems are used to perform ad hoc analyses and answer questions related to departments’ ongoing operations, up-to-date financial standing, sales and co-operation with suppliers, customers (Olszak & Ziemba, 2003).

It is indicated that BI&A facilitates the realization of business objectives through reporting of data to analyze trends, creating predictive models for forecasting and optimizing process for enhanced performance. The value of BI&A for business is predominantly expressed in the fact that such systems cast some light on information that may serve as the basis for carrying out fundamental changes in a particular enterprise. It is stated that BI&A has become the critical component for the success of the contemporary organization (Clavier, Lotriet, & Loggerenberger, 2012; Howson, 2008; Watson & Wixom, 2007; Weis, 2002; Williams & Williams, 2007; Wixom & Watson, 2010). Wells (2008) argues that BI is the “capability of an organization to explain, plan, predict, solve problems, think in an abstract way, understand, invent, and learn in order to increase organizational knowledge, provide information for the decision-making process, enable effective actions, and support establishing and achieving business goals".
Last time a new trend in BI, called “cloud BI” or “BI services on demand,” has appeared. Cloud BI presents a model that provides on demand access to software and hardware resources with minimal management efforts (Tamer, Kiley, Ashrafi, & Kuilbar, 2013). It is reported that cloud BI is a revolutionary concept of delivering business intelligence capabilities “as service” using cloud based architecture that comes at a lower cost yet faster deployment and flexibility (Gurjar & Rathore, 2013). Cloud BI solution has special interest for organizations that desire to improve agility while at the same time reducing IT costs and exploiting the benefits of cloud computing.

The evolution of different BI&A models is presented in Table 1.

<table>
<thead>
<tr>
<th>Type BI&amp;A</th>
<th>Function</th>
<th>Scope</th>
<th>Decision support level</th>
<th>Used techniques</th>
</tr>
</thead>
<tbody>
<tr>
<td>Data Marts</td>
<td>Ad hoc analysis, comparative analysis, reporting</td>
<td>Narrow, limited to unit, department</td>
<td>Operational, well structured</td>
<td>reporting, OLAP</td>
</tr>
<tr>
<td>Data warehouse</td>
<td>Multidimensional analysis</td>
<td>The whole enterprise</td>
<td>Operational, tactical, strategic</td>
<td>OLAP, data mining</td>
</tr>
<tr>
<td>BI with PA</td>
<td>Forecasting of different scenarios</td>
<td>Narrow, limited to unit, department</td>
<td>Operational, tactical, strategic</td>
<td>OLAP, AP</td>
</tr>
<tr>
<td>Real-time BI</td>
<td>Monitoring of current activities, discovering irregularities</td>
<td>Narrow, limited to unit, department</td>
<td>Operational, well structured</td>
<td>EII</td>
</tr>
<tr>
<td>Corporative BI</td>
<td>Corporative management, building loyalty strategy</td>
<td>All actors of value chain</td>
<td>Operational, tactical, strategic</td>
<td>ETL, data mining</td>
</tr>
<tr>
<td>BI portals</td>
<td>Content management and document management, group work</td>
<td>Selected communities</td>
<td>Operational, tactical, strategic</td>
<td>Internet, Web mining, CMS, work group, personalization techniques</td>
</tr>
<tr>
<td>BI nets</td>
<td>The building of expert’ nets, social capital management</td>
<td>Global, various communities</td>
<td>Operational, tactical, strategic</td>
<td>Web mining, Web farming, cloud computing</td>
</tr>
<tr>
<td>BI for everyone</td>
<td>The building of social nets, social capital management</td>
<td>Global</td>
<td>Operational, tactical, strategic</td>
<td>Mobile, social media, semantic Web, Web mining, cloud computing</td>
</tr>
</tbody>
</table>

It should be pointed that although, BI&A applications have become the most essential technologies to be purchased in the last years, the success from such applications is still questionable. The practical benefits from BI&A are often unclear and some organizations fail completely in their BI&A approach. Organizations do not achieve the appropriate benefits (Chaudhary, 2004; Howson, 2008; Isik, Jones, & Sidorova, 2011; Schick, Frolick, & Ariyachandra, 2011; Watson & Wixom, 2007). It is said that about 60 to 70% of business intelligence applications fail due to the technology, organizational, cultural and infrastructure issues (Clavier, Lotriet, & Loggerengerber, 2012; Hannula & Pirittimaki, 2003). It is reported that the most important elements that decide on BI&A success in the organizations include: quality of data and used technologies, skills, sponsorship, alignment between BI and business, and BI use (Davenport & Harris, 2007). Other elements concern: organizational culture, information requirements, politics. According to Olszak and
Ziembka (2012) the biggest barriers that the organizations encounter during the implementation of BI systems have a business and organizational character. Among the business barriers, the most frequently mentioned are: the lack of well defined business problem, not determining the expectation of BI and the lack of relations between business and BI vision system. Whereas as the key organizational barriers the enterprises enumerate: the lack of manager’s supporting, the lack of knowledge about the BI system and its capabilities, exceeded the BI implementation budget, ineffective BI project management and complicated BI project, the lack of user training and support.

**Resource-based View**

The Resource-based View (RBV) argues that about the success of organization’s strategy decide the configuration of its resources and capabilities that are the basis to build key competences. Acquiring, configuration, reconfiguration, and developing of available resources are critical factors for taking the competitive advantage and creating the value (Barney, 1991; Cosik, Shankes, & Maynard, 2012; Wade & Hulland 2004).

RBV was put forward by Wernfelt (1984) and subsequently popularized by Barney’s work (1991). Many authors made significant contribution to its conceptual development (Berney, Wright, & Kitchen, 1991; Eisenhard & Martin, 2000; Zollo & Winter 2002).

According to RBV in order to provide sustainable competitive advantage, resources should be (VRIN): Valuable (enable an organization to implement a value-creating strategy), Rare (are in short supply), Inimitable (cannot be perfectly duplicated by rivals) and Non-substitutable (cannot be countered by a competitor with a substitute). In an extended approach of RBV resources implies intangible categories including organizational, human and networks (Ahn & York, 2011). This knowledge-based resource approach of RBV encourages organizations to obtain, access, and maintain intangible endowments because these resources are the ways in which firms combine and transform tangible input resources and assets (Wiklund & Shepherd, 2003). It is reported that BI&A technology, as well others ICT, do not satisfy the VRIN criteria (“Gartner Magic Quadrant,” 2011). However, they may be synergistically combined with existing organizational resources, to form other VRIN resources (Cosik, Shankes, & Maynard, 2012; Nevo & Wade, 2010).

**Dynamic Capabilities Theory**

The concept of dynamic capabilities is rooted in the RBV of competitive advantage. RBV defines capability as the ability of a bundle of resources to perform an activity. It is a way of combining assets, people and processes to transform inputs into output (Teece, Pisano & Shuen, 1997).

Teece et al. (1997) define capabilities as “the key role of strategic management in appropriately adapting, integrating, and reconfiguring internal and external organizational skills, resources, and functional competences to match the requirements of a changing environment”. Many authors, explaining the topic of capabilities, highlight some differences between competency, capability and capacity (Vincent, 2008). Competence is the quality or state of being functionally adequate or having sufficient knowledge, strength and skill. While capability is a feature, faculty or process that can be developed or improved. Capability is a collaborative process that can be deployed and through which individual competences can be applied and exploited. Capacity is the power to hold, receive or accommodate.

Prahalad and Hamel (1990) coined the term core competence to distinguish those capabilities fundamental to a firm’s performance and strategy. Core competencies are the activities that the firm performs especially well compared to competitors and through which the firm adds value to its goods and services over a long period of time. They emerge over time through an organizational process of accumulating and learning how to deploy organizational resources and capabilities.
Dynamic Business Intelligence and Analytical Capabilities in Organizations

The RBV conceptualizes organizational resources as static, neglecting changes due to turbulent environments. A stable resource configuration can not guarantee long-term competitive advantage as organizations have to adopt this configuration to the market environment (Teece, Pisano & Shuen, 1997). “This argument is even stronger in dynamic market environments where there is rapid change in technology and market forces and feedback effects on firms” (Ortbach et al., 2012). Dynamic capabilities were conceptualized in response to this criticism (Cosik, Shankes, & Maynard, 2012; Eisenhard & Martin, 2000).

Teece et al (1997) identify dynamic capabilities as “the firm’s ability to integrate, build, and reconfigure internal and external competences to address rapidly changing environments”. The notion of dynamic capabilities was subsequently refined and expanded (Eisenhard & Martin, 2000; Helfat et al., 2007). Zollo and Winter (2002) also distinguish dynamic capabilities from operational or ordinary capabilities. Operational capabilities enable firms to perform their every day living, “and while dynamic (as all processes are), they are used to maintain the status quo” (Helfat et al., 2007). By contrast, dynamic capabilities are those that enable a firm to constantly renew its operational capabilities and therefore achieve long-term competitive advantage.

It is worth noting that RBV has been used extensively in IS (Information Systems) research to explain how assets provide value and sustainable competitive advantage to organizations (Cosik, Shankes, & Maynard, 2012). Some studies found a direct link between IT assets and value but most found that IS capabilities and the interaction of IT assets with other organizational resources, lead to business value (Wade & Hulland, 2004). IS capabilities are created through combining IT assets with other resources including people, routines and processes. IS capabilities develop and mature over time as organizational learn (Barney, Wright, & Kitchen, 1991). Dynamic capabilities are the high-order capabilities and thus can be disaggregated into different capacities, such as the capacity for improving quality, the capacity for managing human resources and the capacity for utilizing technologies (Chae & Olson, 2013).

**Conceptualization of Dynamic Business Intelligence Capabilities**

Drawn from the concept of dynamic capabilities, BI&A capability may be defined as IT-enabled, analytical dynamic capability for improving decision making and firm’s performance (Chae & Olson, 2013; Ortbach, et al., 2012). It is a specific and important type of IS capabilities. Different organizational characteristics and strategic goals may also require using different BI capabilities. According to Gartner Group BI capabilities relate to information access and analysis to decision-making style within an organization. Isik, Jones, and Sidorova (2011) delineate information access and analysis capabilities and relate them to the overall BI success. Davenport and Harris (2007) state that analytical capability is a key element of strategy for the business. Wixom, Watson and Werner (2011) argue that BI capability is “a journey over long periods of time during which foundational competencies are developed”. Some authors argue that BI capabilities are critical functionalities of BI that help an organization to improve its adoption to change as well as to improve its performance (Wixom, Watson, & Werner, 2011).

Organizations may develop two activities in order to build BI&A capability. The former concerns the widely understood data exploration, the latter, data exploitation (Lavie, Stettner, & Tushman, 2010). Data exploration enables organization to overcome the bounder of actual knowledge and its capabilities. This may refer to new technical capabilities, market experiences and new relations with the environment. Also, the exploration is a conscious searching of new knowledge sources, enriching of existing resources, adoption of new behavioral orientations and acquisition of new competencies. It can be achieved through: advances data mining, text mining, web mining, intelligent agents, and search based application. Data exploitation concerns the using of existing knowledge bases. It is limited to actual resources and refers to their detail analysis.
Davenport and Harris (2007) distinguished five stages of analytical capability called: “analytical-ly impaired”, “localized analytics”, “analytical aspiration”, “analytical companies”, and “analytical competitors”. The first stage means that “organizations have some desire to become more analytical, but thus far they lack both the will and the skill to do so”. They face some substantial barriers – both human and technical. They may also lack the hardware, software and skills to do substantial analysis. The second stage “localized analytics” is characterized by reporting with pockets of analytical activity. The organizations undertake the first analytical activities, but they have no intention of competing on it. BI activities produce economic benefits but not enough to affect the company competitive strategy. The third stage called “analytical aspirations” is triggered when BI activities gain executive sponsorship. The organizations build the plan of using BI. The primary focus in “analytical companies” stage is building word-class analytical capabilities at the enterprise level. The organizations implement the plan developed in previous stage, making considerable progress toward building the sponsorship, culture, skills, strategic insights, data and technology needed for analytical competition. At the last stage, analytics move from being a very important capability for an organization to the key to its strategy and competitive advantage. Executive manager’s trust in BI and all users are highly educated in BI.

**Methodology**

An interpretative philosophy and an inductive qualitative approach were applied to build a comprehensive, dynamic BI capabilities framework. The theories (from IS and management literature) and studies developed mainly by Davenport and Harris (2007), Wixom, Watson, and Werner (2011), Cosic, Shankes, and Maynard (2012), Ortbach, et al. (2012) were adopted and used to create the dynamic BI capabilities framework.

BI is regarded as an applied discipline and therefore practitioner, viewpoints and opinions were considered of high importance. Therefore, I have used a part of the results from the survey that was conducted in 2012 among 20 purposefully selected firms that are considered to be advanced in BI (Olszak, 2013). They represented small and medium enterprises from the service sector: telecommunications, consulting, banking, insurance, and marketing agencies. Interviews were held with executives, senior members of staff and ICT specialists. Interviewees were selected on their involvement in BI or on their ability to offer an insight based on experience in BI and related decision support systems. The research was of qualitative nature and used as a research technique of an in-depth interview. Types of core interviews questions relevant to this paper have included, among others, the following: (1) Does your organization have a defined BI strategy?, (2) Does your organization have defined business processes?, (3) Are you skilled enough in order to take advantage of BI systems?, (4) Are you motivated to use BI (how)?, (5) Do you use BI for analyzing customers, suppliers, competitors and other business partners? (6) What kind of BI software do you use? (7) Describe some successes/failures from using BI. This methodology is appropriate for the explorative objectives of this research as it aimed to build dynamic BI capabilities framework.

**Results and Discussion**

The conducted interviews in surveyed organizations allow to state that BI&A is used first of all to report operational data, optimize operational decisions, improve of internal business processes and decision making on operational level and to better access to data repositories and data visualization. BI&A is applied mainly in customer relationship management, identification of sales and inventory, optimization orders, determination of profitability (products, customers), and marketing companions. Some organizations indicated the benefits from using BI&A like: integrated analysis for finance, marketing, improvement of decision making on all levels of management,
and the possibility of demand forecasting. They were satisfied from the data visualizations, OLAP analysis, rapid access do big data repositories.

Table 2: BI&A capabilities area

<table>
<thead>
<tr>
<th>BI&amp;A Capabilities Area</th>
<th>Detailed BI&amp;A capabilities in surveyed organizations</th>
<th>Number of surveyed organizations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Governance</td>
<td>Business vision and plan</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>Business analysis planning and monitoring</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>Strategic alignment BI&amp;A and business strategy</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>Decision rights (operational, tactical, strategic)</td>
<td>16</td>
</tr>
<tr>
<td></td>
<td>BI solution assessment and validation</td>
<td>7</td>
</tr>
<tr>
<td>Culture</td>
<td>Executive leadership and support</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>Flexibility and agility</td>
<td>8</td>
</tr>
<tr>
<td></td>
<td>Establishing a fact-based and learning culture</td>
<td>7</td>
</tr>
<tr>
<td>Technology</td>
<td>Data management</td>
<td>16</td>
</tr>
<tr>
<td></td>
<td>Systems integration and interaction with other systems</td>
<td>17</td>
</tr>
<tr>
<td></td>
<td>Flexibility</td>
<td>17</td>
</tr>
<tr>
<td></td>
<td>Reporting and visualization technology</td>
<td>20</td>
</tr>
<tr>
<td></td>
<td>Advanced BI technology (OLAP, data warehousing, data mining, predictive analysis)</td>
<td>16</td>
</tr>
<tr>
<td>People</td>
<td>Securing and building technology skills</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td>Mathematical and statistical skills</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>Organizational skills</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td>Organizational knowledge, knowledge sharing</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>Managing analytical people</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>Business interpersonal communication</td>
<td>8</td>
</tr>
<tr>
<td></td>
<td>Entrepreneurship and innovation</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>Trustworthiness</td>
<td>6</td>
</tr>
<tr>
<td>Process</td>
<td>Holistic overview business process/ knowledge processes</td>
<td>14/7</td>
</tr>
<tr>
<td></td>
<td>Business process/knowledge/ modeling and orchestration</td>
<td>16/6</td>
</tr>
<tr>
<td></td>
<td>Process redesign and integration</td>
<td>16</td>
</tr>
<tr>
<td>Change &amp; Creativity</td>
<td>Monitoring of competitors, customers and current trends in the marketplace</td>
<td>9</td>
</tr>
<tr>
<td></td>
<td>Introducing new business models oriented on change management, knowledge management and customer relationship management</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td>Generation of new and useful products, services, ideas, procedures, and processes</td>
<td>7</td>
</tr>
</tbody>
</table>

The surveyed organizations suffered from limited and insufficient managing analytical people, knowledge sharing, poor motivation for change and creativity. The cultures of surveyed organizations were not focused on flexibility and agility and creative business interpersonal communication. They do not build the social nets and manage social capital. Unfortunately, the digital business strategy or knowledge management strategy were implemented only in a few organizations. In a small degree, organizations were concentrated on competing through BI&A, or new ways of doing business. One gets the impression that BI&A is still treated as a technology and not a way to do new business, and management. The most identified BI&A capabilities in surveyed organizations are presented in Table 2 and Table 3.
### Table 3: Used BI&A models and obtained benefits

<table>
<thead>
<tr>
<th>Enterprises</th>
<th>Used BI&amp;A models</th>
<th>Benefits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Telecommunication</td>
<td>Enterprise-wide BI architecture, BI-PA, customer profiling and segmentation, customer demand forecasting</td>
<td>(1) Determine high-profit product profiles and customer segments, provide detailed, integrated customer profiles, develop of individualized frequent-caller programs, determine future customer needs; (2) Forecast future product needs or service activity, provide basis for churn analysis and control for improving customer retention</td>
</tr>
<tr>
<td>Consulting</td>
<td>Data warehouse, BI-PA, data marts, analysis of parameters importance, identification of sales and inventory, optimization orders, marketing companions</td>
<td>(1) Reduction in the turnaround time for preparation of reports, direct and faster access to the data needed to support decision-making, analyze the flow of businesses across services, regions, clients, pricing, currencies, and market factors in time etc.; (2) Forecasting and estimating of customer demand (in short and long term); (3) Service and product distribution plans of a companies are in place to meet its customer expectations, inventory requirements are more accurately</td>
</tr>
<tr>
<td>Banking</td>
<td>Data warehouse, BI-PA, customer profitability analysis, credit management, branch sales</td>
<td>(1) Determine the overall profitability of individual customer, current and long term, provide the basis for high-profit sales and relationship banking, maximize sales to high-value customers, reduce costs to low-value customers, provide the means to maximize profitability of new products and services; (2) Establish patterns of credit problem progression by customers class and type, warn customers to avoid credit problems, to manage credit limits, evaluate of the bank’s credit portfolio, reduce credit losses; (3) Improve customer service and account selling, facilitate cross selling, improve customer support, strengthen customer loyalty</td>
</tr>
<tr>
<td>Insurance</td>
<td>Regional data warehouses, data mining, OLAP, data marts, claims and premium analysis, customer analysis, risk analysis</td>
<td>(1) Analyzing detailed claims and premium history by product, policy, claim type, and other specifics; (2) Developing marketing programs on client characteristics, improving client service; (3) Identification high-risk market segments and opportunities in specific segments, reducing frequency of claims</td>
</tr>
<tr>
<td>Marketing agencies</td>
<td>Regional data warehouses, OLAP, marketing companions, customer profiling and segmentation, customer demand forecasting</td>
<td>(1) Better understanding of customers, identification their place in a customer lifetime cycle and customer segments for marketing campaigns; (2) Providing analyses of customer transactions (what is selling, who is buying); (3) Monitor customer loyalty by evaluating which customers are loyal and which are likely to leave; (4) Identify which products are most profitable and monitor customer behavior in purchasing products. By closely tracking sales performance and consumer behavior, companies are able to set better marketing strategies and ensure proper allocation of marketing funds</td>
</tr>
</tbody>
</table>

The obtained results allowed proposing an initial framework for dynamic BI capabilities (Figure 2). It includes six capabilities areas like: governance, culture, technology, people, processes, and change management & creativity. So far, these areas were presented separately by the organizations and were used for different aims and tasks. In this study I integrate them into one compre-
hensive model for dynamic BI&A capabilities. Below, I present the arguments for adopting them to create a dynamic BI&A capability.

Figure 2: Framework for BI capabilities

The governance is the mechanism for managing the use of BI&A resources within an organizational and the assignment of BI initiatives with organizational objectives. It also involves continuously renewing BI&A resources and organizational capabilities in order to respond to changes in dynamic environments and mitigating resistance to change (Cosic, Shankes, & Maynard, 2012).

Culture of the organization can be defined as a set of formal and informal codes of behaviors, norms, rituals that are used and accepted within the organization. It plays a significant role in knowledge management as well as in decision-making (Wickramasinghe & von Lubitz, 2007). It means specific philosophy and methodology that would refer to working with information and knowledge, open communication and knowledge sharing (Olszak, 2013).

People refer to all those individuals within organization who use BI as part of their job function. BI initiatives are considered to be knowledge intensive and require technical, business, managerial and entrepreneurial skills and knowledge (Cosic, Shankes, & Maynard, 2012).

Technology (software, hardware, applications, networks and data) forms the foundation for developing different BI activities. It enables organizations to collect data (from different resources), convert them into information and knowledge (through reporting and visualization systems), analyze (through OLAP, data mining), predict trends and optimize business process.

Process constitutes of activities to gather, select, aggregate, analyze, and distribute information. Some of these activities are the responsibility of the BI staff, while others are the joint responsibility of the BI staff and the business units. Processes may be divided into categories: internal and external processes. The first group relates mainly to accounting, finance, manufacturing, and human resources. The second group concerns managing and responding to customer demand and supplier relationships (Davenport & Harris, 2007).

Change management & creativity are organization’s abilities to meet the requirements of dynamic environments. Organizations face rapid change like never before. Therefore, the ability to manage and adapt to organizational change is an essential ability required in the workplace today. Change management is an approach to transitioning individuals, teams, and organizations to a desired future state. BI requires permanent development and adaptation to new challenges and expectations of an organizations. While an organizational creativity is the firm’s ability to
generate new and useful ideas to address rapidly changing opportunities and threats by making timely and market-oriented decisions, and to frame breaking changes in its resource base.

The essentials analysis of the literature and the conducted interviews with various BI experts and managers allowed me to identify the detailed capabilities for each BI&A area. These detailed BI&A capabilities areas were mapped onto Davenport and Harris model. As a the result, a BI&A capabilities maturity matrix was created (Table 4).

The analysis of the literature and the conducted survey allow me to state that the dynamic BI&A capabilities do not go hand in hand with the possibilities offered by BI&A technologies. Most organizations need to raise their "analytical erudition." Managers do not always know how information sources can be used in making decisions. The most of the organizations do not think creatively about the potential of data sources.

Table 4: BI&A capabilities maturity matrix

<table>
<thead>
<tr>
<th>BI &amp;A capabilities area</th>
<th>Analytically impaired</th>
<th>Localized analytics</th>
<th>Analytical aspiration</th>
<th>Analytical companies</th>
<th>Analytical competitors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Governance</td>
<td>Lack of vision and plan</td>
<td>Businesses plans for limited departments</td>
<td>Integrated business strategy</td>
<td>Have an enterprise BI&amp;A strategy</td>
<td>BI&amp;A strategy oriented on customers, suppliers etc.</td>
</tr>
<tr>
<td>Culture</td>
<td>No flexibility and agility</td>
<td>Low support from senior executives</td>
<td>Users are encouraged to collect, process analyze and share information</td>
<td>Establishing a fact-based and learning culture, skill training in BI</td>
<td>Learning from customers, suppliers, communities of practice, social media</td>
</tr>
<tr>
<td>Technology</td>
<td>Missing/poor data, Unintegrated systems</td>
<td>Missing important data, Isolated BI&amp;A efforts</td>
<td>Proliferation of BI&amp;A tools</td>
<td>High-quality of data, integrated knowledge repositories</td>
<td>Enterprise-wide BI&amp;A architecture largely implemented</td>
</tr>
<tr>
<td>People</td>
<td>Users do not know their own data requirements or how to use them</td>
<td>The users take the first BI initiatives</td>
<td>Users try to optimize the efficiency of individual departments by BI</td>
<td>Users have high BI&amp;A capabilities, but often not aligned with right role</td>
<td>Users have capabilities and time to use BI</td>
</tr>
<tr>
<td>Processes</td>
<td>Users do not know business processes</td>
<td>Identification of basic business processes</td>
<td>Standardization of business processes, and building best practices in BI&amp;A</td>
<td>Business process management based on facts</td>
<td>Broadly supported, process-oriented culture based on facts</td>
</tr>
<tr>
<td>Change &amp; Creativity</td>
<td>Fear of change, no creativity</td>
<td>Risk management for selected business process, poor and limited creativity</td>
<td>Building the best practices for change management, individual and team creativity</td>
<td>Integrated risk management, team and organizational creativity</td>
<td>Cooperation with competition, organizational creativity, creative environment</td>
</tr>
</tbody>
</table>

The most of surveyed organizations had a relatively high level of the technical competences. Unfortunately, they did not correspond with another BI&A capabilities, e.g.: strategic alignment.
IT and business strategy, establishing a fact-based and learning culture, entrepreneurship and innovation, change management, and creativity. BI&A is still treated as a technology or tool to acquire and analyze data and not as a trigger for making more effective decisions, improving business processes and business performance, as well as doing new business or creating new ideas and procedures. The organizations still underestimate the soft competences and skills needed for BI&A e.g.: culture-based on facts and knowledge, trust, human resources management, managing analytical/creativity people.

I consider that in order to reach a comprehensive, dynamic BI capability, organizations should simultaneously build and developed a whole bundle of various BI&A capabilities. Undoubtedly, it is a long journey and developed over long periods of time. Organizations should not start from building technical competences, structures (data bases, data warehouses, etc.), without prior the implementation of knowledge-based organization, change management, and organizational creativity.

Conclusions and Recommendations

The research propose of this study was to investigate how Resource-based View and dynamic capability theory may be adopted and used in BI&A area. It was illustrated that they through more light on our BI&A understanding. The comprehensive, dynamic BI&A capabilities framework has been proposed. It reflects six BI&A capabilities areas: governance, culture, technology, people, processes and change & creativity. It has been shown that these capabilities areas should be simultaneously developed in order to integrate, build and reconfigure the information resources, as well as business processes to address rapidly changing environments.

The analysis of the literature and the conducted survey allow to state that the dynamic BI&A capabilities do not go hand in hand with the possibilities offered by BI&A technologies. Most organizations need to raise their "analytical erudition." Managers do not always know how such sources can be used in making decisions. The most of the organizations do not think creatively about the potential of data sources. The organizations still underestimate the soft competences and skills e.g.: culture-based on facts and knowledge, trust, human resources management, managing analytical/creativity people. It is important for the survival and success of the organization to maintain some balance between various BI&A capabilities areas.

References


Dynamic Business Intelligence and Analytical Capabilities in Organizations


**Biography**

**Prof. Celina M. Olszak**, Ph.D., D.Sc is head of the Department of Business Informatics, Dean for Research at the Katowice University of Economics, Poland. DAAD and a Swiss Government scholarship holder. She is author of 10 books and over 150 academic journal articles. Her research and teaching focus on decision support systems, business intelligence, management information systems and information society. She is a member of the Polish Academy of Sciences, PGV Network, and Informing Science Institute in California.
Determining e-Skills Interventions to Improve the Effectiveness of Service Delivery by Community Development Workers

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Abstract

This research case study intends to provide a basis for using Information Communication Technology (ICT) to improve the effectiveness of community service delivery to communities. The ineffectiveness in public service delivery to communities is often ascribed to a number of factors, including e-skills deficiencies. In particular, Community Development Workers (CDWs) in South Africa wish to use ICT to improve the effectiveness of public service delivery to their communities, but CDWs often lack adequate e-skills to do so effectively. This lack of e-skills coupled with the subsequent ineffectiveness in service delivery has necessitated the search for innovative service interventions. In this case study, we have considered the measurement of e-skills levels as an important clue because the state of CDWs is an essential prerequisite for creating effective ICT intervention strategies. A set of self-report measures and a pilot e-skills development training that utilized a studio pedagogy in a Blackboard virtual environment were used to measure, validate and improve the e-skills levels of CDWs. The partial credit probabilistic item response theory was used to estimate item difficulty, item discrimination and pseudo-guessing parameters from the pretest self-reports of 327 CDWs and the posttest self-reports of 189 CDWs. These parameters were used in a maximum likelihood scheme to obtain the estimates of e-skills levels of CDWs. A set of interventions, based on the study findings was recommended.

Keywords: Blackboard, Community, Skill, Studio, Training, Worker.

Introduction

The research case study at hand is reported based on the supposition that Information Communication Technology (ICT) can generally be used to improve the effectiveness of public service delivery to communities. However, efforts by Community Development Workers (CDWs) to effectively use ICT to improve their delivery of public services to communities could be jeopardized by
their lack of adequate ICT skills/e-skills. The CDWs in South Africa are community based resource persons who play important roles in facilitating community development agendas by collaborating with diverse stakeholders. They are cadres of a special type of participatory change agents who work within the specific communities where they are selected - where they live and to whom they are accountable for their civic roles.

The CDWs are supported by a range of government departments, particularly the local governments to provide assistance to their communities (Raga et al. 2012). They have a limited educational background and a shorter educational training period when compared to the tertiary-educated professional development workers. In particular, e-skills development training has not been an integral part of the agenda for CDWs. The primary selection criteria for CDWs to qualify for a formal employment in the public service is to have attained a minimum of grade 11 or equivalent. The basic training of CDWs is accomplished by doing a learnership program for a period of one year. There will be some theoretical work during the training period, however, the emphasis is generally based on community learning and practical experience.

The understanding of the roles of CDWs, their e-skills levels, the technologies they are able to use and their e-skills needs are pertinent issues that could help to improve their service delivery effectiveness. A case study was nominated as a suitable methodology to explore pertinent information that will increase our understanding of CDWs and enable us to empirically measure their e-skills levels. In South Africa context, e-skills means the ability to use ICT within an emerging information society and the global knowledge economy in which ICT has become an essential requisite for advancement in government, business, education and society at large. The guiding questions examined in this research case study are the following.

a) What tasks are mostly performed by community development workers in the workplace using ICT?
   b) How can the e-skills levels of community development workers be practically improved?
   c) What ICT intervention is required for community development workers to practically improve their service delivery effectiveness?

In the next section, we advance the discussion on this research case study by providing important background information. Thereafter, we present the procedures that reinforce this research case study. This is followed by the presentation and discussion of the results of this research case study. In the concluding section, we succinctly delineate the key findings of this research case study and decision to recommend a set of interventions for improving the effectiveness of service delivery using ICT.

**Background**

The background of this research case study summarizes the rationale for the establishment of a community development program and the important civic roles played by CDWs in facilitating community development agendas. In addition, the background information includes the roles of ICT for community development, the impact of e-skills on the effectiveness of service delivery to communities and the rationales for the establishment of the national e-skills plans of action.

**Program for Community Development Workers**

The United Nations (UN) have emphasized that community development workers’ program (CDWP) is a concerned for the global environment with quality of life improvement. In South Africa, the CDWP is an intervention that seeks to improve the quality of the outcomes of public expenditures intended to raise the standards of living of people. The CDWP emphasizes on massive participation of people towards fostering self-reliance and bottom-up strategies for solving
community problems. The South Africa approach to CDWP is based on the principle that by raising awareness among people, the individuals within a community will become highly motivated to appropriately solve their own domain specific problems. The Co-operative Governance and Traditional Affairs (COGTA) have reported that the motivated individuals can develop the required skills to build a collective community that rapidly responds to their own issues.

The fundamental principle of CDWP as articulated in the preamble of the South African constitution, is to “improve the quality of life of all citizens and to free the potentials of each person”. The foundation of CDWP reflects the Batho Pele principles of transforming service delivery in South Africa. It should be considered as a service delivery plan to identify service priority areas and to facilitate effective access to the required services. In addition, it was suggested that CDWP should be embedded in the Integrated Development Plan (IDP) at the municipal level (Raga et al. 2012). The CDWP is widely supported as a developmental intervention for the disadvantaged communities in South Africa because it is aimed at developing and promoting generic development activities within communities. The objectives of CDWP include the following:

a) To promote societal goals such as social justice and equity.

b) To serve as a contract for improved service delivery to the people.

c) To serve as a useful tool for the empowerment of citizen education and deepening democracy.

**Functions of Community Development Workers**

The extension of public services to reach the ordinary citizens is an important contribution for the government to claim as a significant achievement. In South Africa, the majority of communities, especially those in the rural areas, are facing the challenge of not having ubiquitous and equitable accessibility to public services. The Community Development Workers (CDWs) therefore, are functioning as mediators between government and communities in order to increase equitable accessibility of public services in all communities. The many of the functions performed by CDWs can be supported using ICT to improve effectiveness. These functions, according to the 2006 handbook for CDWs, include the following (COGTA 2006):

a) Developing strategies to encourage massive participation of people and raising the awareness of government services and programs within the communities.

b) Alerting people and appropriate service providers on the critical challenges that are associated with the delays in providing basic services to the communities.

c) Disseminating government information to communities in a timely, equitable and in an understandable way.

d) Receiving feedbacks from communities and appropriately directing them to the appropriate service providers.

e) Assisting communities in the effective implementation of government programs, activities and projects.

f) Monitoring and evaluating the impacts of community development projects and submitting reports to the relevant structures of the government.

**Information Communication Technology for Development**

The notion of Information Communication Technology for Development (ICT4D) was flagged as a global development priority by the United Nations (UN) and the group of Eight (G8) of the industrialized world. The general belief is that technology underpins the highly unparalleled levels of prosperity experienced in the developed world. The understanding of ICT4D as an important development issue is therefore rapidly evolving. ICT is generally seen as a significant
productive force in the socioeconomic development of communities – be it rural or urban. The rapid advancement in ICT has led to the following benefits amongst others:

a) The rising standards of living, increased level of literacy, improved health and life expectancy.

b) The improved security, increased access to data, information and services as well as efficient management of data and information.

c) The facilitation of mobility or flow of people and provision of massive opportunity to establish connectivity as well as enable accelerated development.

d) The opportunity for socioeconomic development with the Internet, broadband and the cloud computing technologies playing important roles.

e) The enabler of communities to fully participate in the global knowledge economy and to play key transformational roles in the information society and knowledge economy.

f) The platform for effective delivery of innovative services that are essential for successful global integration.

However, in order to adequately function as an effective ICT user, the knowledge to use, the quality of usage and the intensity of the actual usage are important indicators to access the impact of ICT. The Digital Access Index (DAI) developed by the International Telecommunication Union (ITU) was aimed at measuring the overall ability of individuals in a country to use ICT. In addition, the ICT Development Index (IDI) is a framework to measure the impact of ICT in terms of readiness, usage intensity and ability to use ICT. These indexes (DAI and IDI) stretch the significance of e-skills as an important resource for effective ICT usage. The literature on ICT4D shows that skills, which inevitably include e-skills are prominent factors to deal with social challenges such as poverty, unemployment and inequity facing humanity.

**Impact of e-Skills on Service Delivery Effectiveness**

The policymakers across the developed parts of the world have persistently insisted that skills are prime to the socioeconomic success of a nation. In particular, ICT skills or e-skills to effectively interact with computing systems are an essential requirement to successfully participate in the knowledge economy and information society. However, there is a growing conviction that if skills are to optimally deliver the kind of services that will lead to huge impact on people, these skills have to be utilized in the workplace and in the business world. However, the existing gap between service delivery efforts of the government and abilities of communities to benefit from the delivered services has been highlighted as a challenge in South Africa (The World Bank, 2011). The delivery of government services at national, provincial and local levels is not always appropriate nor effective in reaching the intended recipients (Pretorius & Schurink 2007). This challenge is often attributed to a number of factors, including the shortage of ICT related skills/e-skills in the local government sphere and the ability to effectively manage human resources. The e-skills challenge, which is generally concerned with the inability of people to meaningfully apply ICT, has been identified as a serious problem in South Africa and even globally.

The building of South Africa e-skills to respond to the service needs, strategic development plans and policies of the country is crucial. However, the lack of ability to adequately use ICT has a deteriorating impact on the effectiveness of service delivery. In the present rapidly changing world of ICT, there is a high likelihood that in the near future, people who do not possess adequate e-skills are likely to have difficulty in accessing quality education and improved services. They will have difficulty in getting decent jobs and they will not be able to improve their social life. In addition, the inability to use ICT has a debilitating impact on the global image of a country. For instance, the lack of appropriate skills was identified as a major contributing factor in ranking South Africa much lower in 2012 than in 2007 in the global electronic readiness (e-
readiness) report produced by the World Economic Forum (WEF). This inability to effectively use ICT has made it difficult for CDWs to adequately provide a bridge between government and communities. In particular, it will be hard for CDWs to completely succeed in fulfilling their crucial obligations without adequate e-skills. The development of e-skills levels of CDWs should be considered an important success factor towards empowering CDWs for effective use of ICT to innovate the delivery process of public services to communities.

**National e-Skills Plan of Action as Developmental Lens**

The e-Skills Institute (e-SI) is the organ in the Department of Communication (DoC) that initiated the National e-Skills Plan of Action (NesPA) as a holistic process to help move South Africa towards a knowledge economy and information society. The underpinning philosophy of NesPA revolves around people-centric development as highlighted in the South Africa (SA) National Development Plan (NDP) (SA-NDP) 2030 of building the needed abilities for increasing self-reliance. The primary goal of NesPA is to develop astute citizens to build an inclusive economy in a developmental stage that is increasingly dominated by modern ICT abilities. The concept of electronic astuteness (e-astuteness) as invented by e-SI, refers to the ability of an individual to use ICT for personal development and self-reliance. The e-astuteness encompasses the ability across the full spectrum of society that would allow individuals and collectives to exploit ICT for individual or group benefit (Mitrovic, et al. 2013).

The DoC is the government department responsible for driving the national agenda of e-Skilling the South Africans for economic prosperity and global competitiveness through the e-SI. The institute was recently launched by the DoC as Ikamva National e-Skills Institute (iNeSI) on 21 of February, 2014 at Durban University of Technology. This memorable launching event was well attended by many professionals and high power government dignitaries, including the Mayor of Ethekwini Municipality, the Minister of Communication and the Minister in the Presidency in charge of the national planning commission. The iNeSI is a merger of the e-Skills Institute (e-SI), the National Electronic Media Institute of South Africa (NEMISA) and the Institute for Satellite and Software Applications (ISSA) into a state-owned company. The iNeSI is a globally recognized collaborative model that allows stakeholders to achieve and to sustain the main objectives of e-Skilling the South Africans. The e-Skilling objectives are aligned to the broadband policy of South Africa Connect (SAConnect), the National Development Plan (NDP) as well as other national and international developmental goals.

The mandate of e-Skilling a large mass of South Africans follows the 2007 recommendations of the Presidential International Advisory Council (PIAC) on the national structural thesis of information society and development. The e-SI has adopted a multi-stakeholders collaborative approach by engaging government, business, civil society, education sector and organized labor to rapidly respond to the e-skills challenge in South Africa. This collaborative approach adopted by e-SI is in line with the deliberations in developing the SA-NDP vision 2030. In these deliberations, a coordination within government, private sector, education and civil society along with people centric development was identified as a prime towards achieving knowledge economy and information society. As a result, NesPA may be seen as a developmental lens through which the process of e-Skilling may be adequately focused to guide the development of knowledge economy and information society.

**Study Procedures**

The procedures of this research case study comprise of identification of the study participants, pilot training execution and empirical measurement of e-skills levels. The Evidence Centered Design (ECD) principles were used to capture the intricacies of empirically measuring e-skills levels of CDWs. The ECD principles have prompted the stakeholders of e-skills agenda to carefully
cogitate on critical decision attributes such as the purpose of the e-Skilling, the fundamental assumptions about the citizens to be e-skilled, the intended claims to be deduced from the outcomes of the e-Skilling and the evidence to support claims of success. The NesPA 2010 and NesPA 2013 documents provide the details of these important decision attributes. The ECD enables an evidence based analysis to be performed that addresses the germane issues of measurement validity and generalization of findings. The construction of a measurement procedure within the ECD framework allows for an appropriate choice of methodologies, identification of study participants and reporting protocols.

**Study Participants**

The population of the study participants of this research case study is the entire 469 CDWs from the KwaZulu-Natal (KZN) province in South Africa. The CDWs from KZN participated in this research case study because of their practitioner roles. The provincial manager, the senior manager at COGTA as well as representatives of e-SI and KZN Co-lab were directly responsible for coordinating the success of this project. In particular, the provincial manager and the senior manager at COGTA coordinated the participation of CDWs in the research project.

The 327 (70%) CDWs provided the pretest data and 189 (81%) of the 234 CDWs who participated in an e-skills development training provided the posttest data. Maintaining sample sizes of 327 of about 70% of the total CDWs in the KZN province and 189 of about 81% of 234 CDWs who participated in the pilot training, allow for the use of inferential analysis. This research case study was expected to be extended to the Northern Cape province of South Africa. The extension of the research case study to CDWs from other provinces is appropriate because the group largely consists of institutions with similar visions and missions.

**Pilot Training**

In this research case study, we have considered e-skills development training as an important principle because someone contemplating embarking on an evidence based study must have a conception of the intended recipients and should be able to provide an adequate avenue for knowledge sharing. In addition, this could ensure the deduction of coherent findings regarding the determination and the validation of e-skills levels of CDWs. The pilot training was initiated by line managers in government who identified the need to train CDWs in the use of ICT. The e-SI tasked the KZN e-skills Co-lab at Durban University of Technology (DUT) with the responsibility of implementing the pilot training project. In addition, the Co-lab was tasked to research on the effectiveness of the pilot training. The functions of CDWs perfectly align with service delivery, which is the thematic area of the Co-lab – “e-enablement of government services”. Moreover, the DUT is one of the partners in the e-SI collaboration network.

The pilot training was optimally designed using the internet technology to enable the CDWs to access learning materials from every community in the KZN province. The use of the internet technology minimized mobility or flow of people to attend the training at a central location. The pilot training was therefore executed through a teaching and learning technology that CDWs could access on their laptops at different locations. Moreover, the design of the pilot training allowed for consistent delivery of training and learning as well as reduction of device related issues as individuals were able to access internet by bringing their own devices. The execution of the pilot training spanned two weeks, 4 days per week for each group of CDWs and there were two groups of CDWs who were successfully trained. The training periods translated to a total of 5 hours per day that resulted in 20 hours effective contacts per group. The training ran across 11 centers in 8 districts in the KZN province. In total, 234 (49%) of the envisaged 476 CDWs were successfully trained, 3 coordinators and 12 facilitators attended the training from 28 municipalities across 8 districts of the province. The training lessons were accessed online under the guid-
Training facilitator at each training center. The facilitators were individual ICT experts who facilitated the training and kept CDWs on task.

**Training facility**

The training centers were inspected before the training actually started in order to ensure the availability of adequate training and learning facilities. The Blackboard internet technology platform was used for the training (Figure 1). This platform is a Virtual teaching and Learning Environment (VLE) that provides an internet access to learning materials and lessons. Blackboard is one of the leading commercial internet-based teaching and learning platform developed by the Blackboard Inc, which is based in America. Blackboard is widely used by many universities across America, Europe and Australia to provide a web-based learning experience, an assessment tool and a submission facility for users. Blackboard is a platform adopted by the Durban University of Technology (DUT) to support modern teaching and learning pedagogies. The technology provides an innovative alternative to the conventional content based teaching and learning. Blackboard is beneficial to CDWs because it eliminates geographical boundaries, saves mobility costs, accommodates multiple learning styles, leverages limited teaching resources as well as scales information and knowledge.

![Figure 1: The training lessons delivered in the Blackboard environment](image)

The CDWs were given continual access to the online training materials and lessons for at least one year of post training to encourage long-life learning and to enable quick references to learning materials. In addition to the training lessons and materials available within the Blackboard, the facilitators had the training lessons and materials on their Universal Serial Buses (USBs) to provide an alternative in case internet connectivity becomes a problem at a training center. The problem of internet connectivity was experienced at some training centers and it prevented the CDWs from the affected centers to be familiarized with Blackboard. The facilitators had to rely on the courseware saved on their USBs to ensure the smooth running of the training and learning.

**Training expectations**

The coordinators who were responsible for coordinating the activities of CDWs reported before the start of the training that CDWs have the expectations of being taught. The coordinators further
Determining e-Skills Interventions

mentioned that most of the CDWs were at a low level of e-skills while some of them may be at a higher level of e-skills. The training expectations of CDWs were extensively discussed at a number of planning meetings. The facilitators were encouraged to use a better training and learning pedagogy to help the CDWs to follow the step-by-step instructions. In order to adequately accommodate the diversity in the e-skills levels of CDWs, it was agreed to offer a range of e-skills development training from the basic word processing to a more advanced internet application.

In order to adequately address the training expectations of CDWs, an interactive studio based training and learning pedagogy was implemented. The studio pedagogy guided the CDWs through a holistic process of e-skills development, while concurrently training them in the use of ICT. The studio environment enabled a small group of CDWs to work on the class activities while receiving continual guidance from a facilitator. The studio pedagogy was implemented in the Blackboard environment to incorporate step-by-step text and graphical instructions (Figure 2). The text and graphical instructions were preferred to the video instructions because video lessons would be more difficult to logically guide the CDWs. In addition, the video instructions may not accurately accommodate the cultural diversity, listening skill and writing skill of the individual CDWs. These important decision criteria have influenced our choice of text and graphical based instruction delivery using a studio pedagogy to stimulate active learning amongst CDWs in the Blackboard environment.

The training program was organized into 15 different lessons, ranging from very basic to a more challenging ICT application. The CDWs were at liberty to select a particular lesson that suits their competency levels and relevant to their workplace (Figure 3). This freedom of choice promotes personalized learning. The concept of personalization refers to a strategy to achieve learning goals for an individual learner. The facilitators reported that CDWs were able to quickly adapt to work on various aspects of the lessons they found relevant to their workplace. The general feedbacks provided in the satisfaction survey and by the word of mouth from individual CDWs were impressive as they unanimously demanded for a follow-up training. The feedbacks generally indicated the effectiveness and the acceptance of the pilot e-skills development training.
Figure 3: List of lessons organized in order of complexity with lesson 1 as basic and lesson 15 as a more advanced

Training lessons

The training program was organized into fifteen different lessons that were developed to incorporate word processing, spreadsheet application, Google Map, search engine, Dropbox and community Facebook. Each lesson had a set of exercises to be completed by the CDWs who were expected to submit a minimum of eight exercises online. The CDWs were encouraged to provide more of their job related practical samples that were developed into the training lessons and incorporated into the Blackboard. The fifteen sample lessons developed for CDWs are discussed as follows:

a) Lesson 1 (Keyboard) - this is an introductory lesson to help CDWs identify the functions of different keys on the keyboard system.
b) Lesson 2 (Word menu) - the menu system is an important stepping stone for many ICT applications. If a menu system is well taught, many CDWs could find it easy to use different applications. This lesson introduces the concept of a menu system in a systematic way.
c) Lesson 3 (Word tables) - tables are used very often in various ways in order to effectively manage document. This lesson shows a step-by-step guide on how to create tables within a word document.
d) Lesson 4 (Spreadsheet) - many of the report templates that are used by CDWs are in the spreadsheet format. It was therefore important to teach the concepts of formulae, graphs and data analysis using a spreadsheet system. This lesson guides CDWs to use a spreadsheet system for data analysis.
e) Lesson 5 (Presentations) - CDWs are faced with the task of frequently disseminating information within their communities and they are therefore required to speak to groups of people. The use of a presentation software could lead to a better understanding of how to present information. This lesson covers how to create “good” presentations in a presentation system.
f) Lesson 6 (Emails) - even though CDWs have the email addresses of their workplace as “xxxx@cocta”, having a private email address would allow CDWs to experiment with emails. Moreover, it would contribute towards making ICT part of everyday life of
CDWs. This lesson explains how to create email addresses as well as send and receive emails.

(i) Lesson 7 (Facebook) - being able to adequately use Facebook would lead to user confidence with social network systems. Some aspects such as privacy and ethics could be easily introduced and illustrated using a network system such as Facebook. This lesson explains how to create Facebook accounts and to establish communication with people using Facebook.

(h) Lesson 8 (Community Facebook) - once a Facebook page for an individual has been created, it could serve as an effective communication tool within a community. Facebook is widely available on many cellphones and if CDWs could create a Facebook page for their communities, they may find greater interaction taking place within the communities. This lesson explains how to use Facebook for interacting with people within the communities.

(i) Lesson 9 (Dropbox) - the concept of cloud computing and using an application such as Dropbox to access information from anywhere is emerging for future ICT applications. This lesson, therefore explains how to create and use a Dropbox to store and exchange data.

(j) Lesson 10 (Internet search) - CDWs were introduced to some advanced searching techniques. They (CDWs) were encouraged to search for topics such as “government department sites”, “awareness and campaigns” and topics of interest to their communities. This lesson explains how search engines could be effectively used to discover and access information on the internet.

(k) Lesson 11 (More than searching) - the integrated environment offered by the Google search engine is a powerful tool that was introduced to CDWs. Document sharing could effectively be used by CDWs to facilitate interactivity. The Google drive was also covered in this lesson and CDWs found the integrated environment of Google more appealing.

(l) Lesson 12 (RSS feeds and web technology) - many websites show the Rich Site Summary (RSS) icon to indicate that RSS feeds are available. The various uses of RSS were explained in this lesson, but CDWs did not appear to think that RSS feed was of much value to them.

(m) Lesson 13 (VOIP and IM) - the concept of using applications such as Skype, WhatsApp and related technologies to communicate at a cheaper price rate was discussed in this lesson. The possibility of conference calls using these technologies in place of face-to-face meetings was introduced in this lesson.

(n) Lesson 14 (Spreadsheet charts) - during the delivery of this training, some CDWs expressed interest in spreadsheet charts. This lesson was therefore added to the list of lessons to introduce advanced spreadsheet features.

(o) Lesson 15 (Google maps) - while discussing some of their job requirements, the CDWs identified their inability to use ICT to locate areas. Consequently, a lesson on how to use the Google maps engine to locate areas was introduced. This lesson demonstrates the various applications of Google maps.

Training pedagogy
The studio pedagogy was implemented in a Blackboard environment and used to facilitate self-directed learning amongst CDWs. Hands-on practical work was promoted because it is often said that the best way to learn is by doing. Moreover, people say actions speak louder than voice. The CDWs completed different practical exercises that were graded online and the final grade obtained was reflected in the certificate of attendance. If CDWs managed to complete the exercises for a lesson, it means they have worked with different applications which is what is being promoted. The successful completion of certain exercises by a CDW gave an indication that a
certain level of work was done using ICT and the CDW should be rewarded accordingly. The rule of thumb for the merit award is simply as follows. Each CDW was expected to submit a minimum of eight exercises for which a pass (50%) was awarded. An overall pass mark of 65% was awarded for correct answers to the exercises. A distinction mark was awarded for a submission of at least ten exercises. However, a fail mark was awarded for a submission of less than eight exercises.

The pilot training was logically conducted in a studio based Blackboard environment to deliver class activities such as lessons, exercises, assignments, tasks or projects between November – December 2013 as follows:

a) The CDWs logged into the Blackboard environment from their laptops to complete class activities. Those who have not completed a pretest assessment were requested to do so by answering a set of questions designed to tap on their ability to apply ICT in the workplace.

b) The CDWs collaboratively work in small groups of about 2-4 persons to cooperatively develop their e-skills. The CDWs were at liberty to freely select those colleagues, they are comfortable working with, as a team. However, a conscious decision was taken not to provide CDWs with printed materials to guide class activities, thereby encouraging the direct use of e-skills to access those materials online.

c) The Blackboard provides step-by-step instructions to CDWs in order to facilitate active learning. The instructor provides guidance on demand by serving as on-hand resources for CDWs to use for class activities. This mechanism minimizes unnecessary lectures and paves the way for a more productive interaction between CDWs and the instructor.

d) The class activities build on each other in tandem to provide a dynamic learning environment that emphasizes on personal skills development, instead of content learning. Each class lesson was paired with a set of exercises that emphasize on the applications of ICT in the workplace. All class exercises were completed and submitted online through Blackboard to encourage e-skills development. The exercises were part of the step-by-step instructions for each e-skills category. There was no time limit to complete an exercise, but an exercise session is not more than one hour to avoid loss of concentration.

e) The CDWs were at liberty to work on class lessons they found most relevant to their workplace in order to ensure a more progressive path. The emphasis was more on the mastery of work-related e-skills and not on passing an examination. A particular attention was given to the ability of CDWs to navigate through the list of lessons and to adequately provide responses.

f) The CDWs were required to complete self-report posttest measures of their e-skills levels and self-report measures of their satisfaction of the pilot training. These measures were designed to respectively tap on the cognitive skills and affective behaviors of CDWs. The posttest was implemented about two months after the completion of the pilot training to allow for sufficient time to enable CDWs to practically test the applicability of the acquired e-skills at the workplace.

**Empirical e-Skills Measurement**

The policymakers need some kind of evidence-based measures obtained from a rigorous quantitative measurement in order to accurately determine the impact of a development initiative. This measurement is particularly important because it provides a barometer for policymakers to judge the fulfillment of their responsibilities and to determine the extent that their goals have been achieved. The evidence based measurement results should ideally inform policymakers about the success of the initiative or the policy, convince them to support the initiative, provide a basis to
refine existing initiative and justify the appropriateness of budget allocation to implement the initiative.

The e-skills levels were empirically measured using self-report measures that CDWs responded to before the training (pretest) and after the training (posttest). The differences in the pretest and the posttest results should ideally reflect whether or not e-skills development had occurred as a result of the pilot training. The pretest-posttest method enables the real-time monitoring and evaluation of the impact of the pilot training. The e-skills can be categorized into five main categories in order to accurately measure them. The “report writing” category, for instance, has a measure of “I have the skills to create a well formatted human settlement report using a word processor” in the pretest measurement instrument (Table 1). This measure is synonymously written for the posttest measure as “My skills to create a well formatted human settlement report using a word processor has improved as a result of the e-skills training development” (Table 2). These categories of e-skills are briefly discussed as follows.

a) Report writing – the ability to use word processing software to write well formatted reports.
b) Presentation design – the ability to design attractive presentations using a presentation software.
c) Internet search - the ability to use a search engine to find relevant information on the internet.
d) Data management – the ability to use a spreadsheet software to efficiently analyze data.
e) Information communication – the ability to use a communication software to interact with people in an appropriate way.

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Q34 I have the skills to collect information using a Really Simple Syndication (RSS) feeds reader.

Q35 I have the skills in accessing government information and services (health, agriculture, education, funding, aviation, tourism) using a search engine.

**DATA MANAGEMENT**

Q36 I have the skills to analyze data using a spreadsheet software.

Q37 I have the skills to set up a financial budget using an electronic spreadsheet.

Q38 I have the skills to capture associated data in a structured format using electronic media.

**INFORMATION COMMUNICATION**

Q39 I have the skills to facilitate mobile interaction between community members and government representatives using social media such as SMS, email and Twitter.

Q40 I have the skills to synchronize calendars on mobile and desktop devices using electronic media.

Q41 I have the skills to set up a meeting across and within different spheres of government using electronic media.

Q42 I have the skills to set up a group on an email account using electronic media.

Q43 I have the skills to create new network collaboration using social media.

<table>
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<th>Code</th>
<th>Item Category versus Item Measure</th>
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| **REPORT WRITING**

Q25 My skills to create a well formatted human settlement report using a word processor has improved as a result of the e-skills development training.

Q26 My skills to report poverty issues to my information manager using a document template has improved as a result of the e-skills development training.

| **PRESENTATION DESIGN**

Q27 My skills to create and convey information on HIV/AIDS awareness using an electronic presentation software has improved as a result of the e-skills development training.

Q28 My skills to create suitable posters to manage utilities usages, human right and civil responsibilities issues using a presentation software has improved as a result of the e-skills development training.

| **INTERNET SEARCH**

Q29 My skills to discover crop management information from a government portal or a website using a search engine has improved as a result of the e-skills development training.

Q30 My skills to access crop market prices from a government portal or a website using a search engine has improved as a result of the e-skills development training.

Q31 My skills to search for supply chain tender in a government portal or a website using a search engine has improved as a result of the e-skills development training.

Q32 My skills to find funding opportunities, donors and development agencies in a government portal or a website using a search engine has improved as a result of the e-skills development training.

Q33 My skills to access and download government agency related information and forms using a government portal or a website has improved as a result of the e-skills development training.
Q34 My skills to collect information using a Really Simple Syndication (RSS) feeds reader has improved as a result of the e-skills development training.

Q35 My skills in accessing government information and services (health, agriculture, education, funding, aviation, tourism) using a search engine has improved as a result of the e-skills development training.

**DATA MANAGEMENT**

Q36 My skills to analyze data using a spreadsheet software has improved as a result of the e-skills development training.

Q37 My skills to set up a financial budget using an electronic spreadsheet has improved as a result of the e-skills development training.

Q38 My skills to capture associated data in a structured format using electronic media has improved as a result of the e-skills development training.

**INFORMATION COMMUNICATION**

Q39 My skills to facilitate mobile interaction between community members and government representatives using social media such as SMS, email and Twitter has improved as a result of the e-skills training program.

Q40 My skills to synchronize calendars on mobile and desktop devices using electronic media has improved as a result of the e-skills development training.

Q41 My skills to set up a meeting across and within different spheres of government using electronic media has improved as a result of the e-skills development training.

Q42 My skills to set up a group on an email account using electronic media has improved as a result of the e-skills development training.

Q43 My skills to create new network collaboration using social media has improved as a result of the e-skills development training.

**Measurement theory**

The partial credit model, which is based on the Item Response Theory (IRT) implemented in the Item And Test Analysis (IATA) software was used to empirically estimate the IRT parameters from the responses provided by CDWs. The IATA is a software package for the analysis of psychometric and educational assessment data (Cartwright, 2013). Briefly in the form of an introduction, the IRT, which is sometimes called latent trait model provides a model based linkage between responses such as questions, items, tests, or measures and latent traits such as e-skills, abilities, proficiencies or competences assessed by a test or a scale. In general, IRT is a probabilistic model that explains the response that a person gives to an item. The theory postulates that the probability that a random person with a given ability answers a random item with a difficulty level correctly is conditioned on the ability of the person and the item difficulty. On one hand, a person with a high ability in a given field of study will probably get an easy question correctly. On the other hand, a person with a low ability will always get a difficult question incorrect.

The Classical Test Theory (CTT) was operationally used prior to the development of IRT, to estimate the score that an individual obtains on a test. The palpable difference is that CTT considers a test as the unit of analysis, but IRT analysis focuses on the test item. The apparent problem with CTT is that test items may significantly vary in terms of their difficulty and discrimination power. The result of the scores produced by CTT methods may therefore present inaccuracies that can be avoided using IRT methods. The IRT effectively solved the problems facing CTT methods by focusing on the item as the unit of analysis. In the simplest case of IRT application, data are comprised of a sample of individuals who dichotomously responded to a set of tests or scale items. The goal is to estimate the characteristics of the items and the individuals. The partial credit model, which is also called the graded-response items, are the polytomous test items that have more
than one score value. The analysis of a partial credit item assumes that an examinee who has achieved a particular item score has also mastered whatever level of skill that is associated with a lower score on that item. That is, if each score is treated as a separate test item, then an examinee with a high partial credit score has also effectively performed correctly on the lower credit scores. The dichotomous response is therefore a special case of polytomous response and results of dichotomous item response models can be extended to polytomous item response models.

**Usefulness of measurement theory**

The CTT/IRT is useful if the data fit the theoretical model and the primary indicator of an item quality is the discrimination power. The important classical item statistics that are good indicators of the usefulness of an item are – the item discrimination index (“Discr”), the point-biserial correlation (PBis) and the item facility (“PVal”) - also sometimes called the item difficulty.

a) The item discrimination indicates the extent to which an individual item measures what the whole test is measuring. If all examinees produce the same response to an item, regardless of their levels of proficiency, the item cannot discriminate between the different levels of proficiency of the examinee. The high positive value of discrimination, which should be greater than 0.2 indicates that the item is good at discriminating between high ability and low ability examinees.

b) The point-biserial correlation relates the scores that examinees obtain on a given item and the total scores the examinees obtain on the overall test. A large positive value of point-biserial correlation, which should be greater than 0.2 indicates that examinees with high scores on the overall test indicate the item rightly answered and examinees with low scores on the overall test indicate the item wrongly answered.

c) The item facility whose value ranges between 0 and 1 describes how easy an item is for the given sample with larger values indicating an easier test item. The value of 0 indicates that no examinees responded correctly and a value of 1 indicates all examinees responded correctly.

The CTT parameters, within the IRT framework correspond to a-parameter, b-parameter and c-parameter. These IRT parameters are discussed as follows.

a) The a-parameter represents item discrimination. The larger the value of this parameter, the steeper the slope of the Item Response Function (IRF) that is sometimes called the Item Characteristic Curve (ICC). This also implies the more an item discriminates between the examinees with high ability and low ability. The IRF is the plot of the probability of a correct response to an item as a function of the ability and it represents the relationship between an item and the overall test performance.

b) The b-parameter represents the item difficulty. The values of this parameter are usually scaled as z-scores so that an extreme negative value such as -3 would correspond to very easy item, the value of 0 would be regarded as moderate difficulty and an extreme positive value such as +3 would be regarded as a very difficult item.

c) The c-parameter represents a pseudo-guessing parameter that shows the estimate that an examinee who knows nothing will not always select the correct answer for a specific item.

The IRF and the distractor table are used in addition to CTT/IRT statistical parameters to determine the relative usefulness of different test items. The distractor analysis is used to determine the errors arising from the poor wording, confusing instruction, sampling error and miskeying of items. The following guideline was used in this research case study to identify a set of useful items with the aid of the IATA software:
Determining e-Skills Interventions

a) A useful item will have a strong relationship with e-skills as indicated by an IRF that has a strong S-shape because of high values of the steeper slope parameter.

b) The correct column option on the distractor table, which is denoted by the asterisk (*), should have a high percentage for the high group and successively lower percentages for the medium and the low groups.

c) For the low skilled group in the distractor table, the percentage of examinees choosing the correct option should be lower than the percentage of those examinees choosing any one of the other options.

d) For the highly skilled group in the distractor table, the percentage of examinees choosing the correct option should be higher than the percentage of examinees choosing any one of the other options.

Measurement of e-skills levels

The maximum likelihood algorithms are naturally used for ability or skill estimation in the application of the item response theory. The maximum likelihood algorithm considered in this research case study is an iterative process that begins with a priori value of e-skills, giving the values of item parameters and response pattern of an examinee (CDW in this research case study). The response pattern is usually a sequence of Bernoulli values, so for non-Bernoulli responses, a suitable algorithm has to be applied to transform the responses to Bernoulli. The a priori e-skills and the item response parameters are used to compute the probability of the response pattern of the examinee. The adjustment to the estimated e-skills is then obtained that improves the agreement of the computed probabilities with the response pattern of the examinee. This process is repeated until the adjustment in the e-skills value becomes sufficiently small that the observed change in the estimated e-skills is negligible.

The mathematical formulation of this iterative process (Baker, 1992) as implemented in this research case study using the C++ programming language is given as follows:

\[
\hat{\theta}_{i,s+1} = \hat{\theta}_{i,s} + \frac{\sum_{j=1}^{n} a_j (r_{i,j} - p(\hat{\theta}_{i,s} | a_j, b_j, c_j))}{\sum_{j=1}^{n} a_j^2 p(\hat{\theta}_{i,s} | a_j, b_j, c_j)(1 - p(\hat{\theta}_{i,s} | a_j, b_j, c_j))}
\]

(1)

Where:

a) \( \hat{\theta}_{i,s} \) is the estimated e-skills of the \( i^{th} \) CDW within the \( s^{th} \) iteration, \( 1=1,2, ..., m. \)

b) \( a_j \) is the discrimination parameter of the \( j^{th} \) item, \( j=1,2, ..., n. \)

c) \( b_j \) is the difficulty parameter of the \( j^{th} \) item.

d) \( c_j \) is the pseudo-guessing parameter for the \( j^{th} \) item.

e) \( r_{i,j} \) is the response made by the \( i^{th} \) examinee to the \( j^{th} \) item.

f) \( p(\hat{\theta}_{i,s} | a_j, b_j, c_j) \) is the probability of a correct response to the \( j^{th} \) item, given the item parameters at the e-skills of the \( i^{th} \) CDW within \( s^{th} \) iteration.

The probability of a correct response to the \( j^{th} \) item is given according to the following logistic function:

\[
p(\hat{\theta}_{i,s} | a_j, b_j, c_j) = c_j + \frac{1 - c_j}{1 + \exp(-a_j(\hat{\theta}_{i,s} - b_j))}
\]

(2)
In this research case study, e-skills of all CDWs were distributed over a range of e-skills levels on a specified e-skills scale, so that all CDWs within a given point on the e-skills scale have the same e-skills level. The e-skills scale is a 7-point Likert scale, where major points on the scale are interpreted as follows. The point 1 means extremely unskillful, 2 means very unskillful, 3 means somewhat unskillful, 4 means moderately skillful, 5 means somewhat skillful, 6 means very skillful and 7 means extremely skillful. This categorization has enabled us to identify a set of CDWs with similar needs, for example, those who required further training on a particular topic they found hard to master.

Measurement instrument

The need for relational analysis of data has led to the choice of using a measurement instrument to solicit for forty three distinctive self-report measures. The first twenty four measures were used to collect social data about CDWs who participated in this research case study. The remaining nineteen measures which are categorized into five categories were used to collect data that were used to empirically measure the e-skills levels of CDWs. The different aspects of the measurement form the basis for the construction of the forty three self-report measures. The self-report measure is often judged in the literature as the most cost-effective and valid means of collecting personal information about people (Baker & Brandon, 1990, Glasgow, et al. 2005). The measurement instrument of this research case study was designed to collect self-report measures because asking a set of good questions would afford the CDWs the opportunity for deeper thinking. In addition, these measures provide the training facilitators with a significant insight into the extent and the depth of e-skills levels at prior and post training regimes.

The ability of CDWs to accurately respond to a measurable item at the established scores was measured by having them to use a five-point Likert scale with the rubrics shown in Table 1 and Table 2. The high response corresponding to a score of 5 indicates “excellent skills”, the low response that corresponds to a score of 1 indicates “no skills”. Moreover, the intermediate response corresponding to a score of 2 indicates “limited skills”, a score of 3 indicates “average skills” and a score of 4 indicates “good skills”. It should be noted that these responses were not the true reflection of the e-skills levels of CDWs because they were subjective self evaluation ratings provided by individuals CDWs. The estimates of the true e-skills levels of CDWs were calculated by the maximum likelihood mathematical model given by equation (1), taking into cognizance the IRT parameters mined from the responses of CDWs.

The design of the self-report data accompanying the e-skills measurement allowed cognitive-affective variables to be recorded and displayed in a spreadsheet relational data format. The cognitive-affective personality system proposed by Mischel & Shoda holds promise for an e-skills performance based measurement (Mischel & Shoda, 1995). On one hand, the latent traits that correspond to the e-skills of CDWs may be understood to be a cognitive function. On the other hand, the inclusion of affective measures of performance as recognized in the field of educational assessment, evaluation and research, contribute to the measurement that reveals the behavior of CDWs towards the pilot training. The affectionate self-report measures were 35 items incorporated into the measurement model of this research case study using a five-point Likert scale. The measures were informed by the concept of training service satisfaction that would yield a more complete understanding of self-confidence of CDWs to use ICT to enhance the effectiveness of service delivery. Moreover, it tells us more about the perceptions of CDWs on the pilot training and their ability to achieve proficiency in ICT. The affective measurement model, although not discussed in this paper was based on customer service satisfaction metrics of satisfaction, complaint, loyalty, image, perceived value, perceived quality and training expectation (Wisniewski, 2001; Turkyllmaz & Ozkan, 2007; Singh & Khanduja, 2010; Yoon & Bae, 2010; Zaim, et al., 2010).
Determining e-Skills Interventions

Validity of measurement instrument
In an attempt to explore a set of job related metrics for the measurement of e-skills levels, we engaged in an extensive scoping review of the issues surrounding data validation. The concept of data validity can be understood from the literature to mean an integrated judgment of the degree to which an empirical evidence and theoretical rationales support the appropriateness of inferences, propositions or conclusions (Cronbach, 1955; Messick, 1980; Kane, 1992; Cook & Beck- man, 2006; Gomez & Elliot, 2013). The reliability of a measurement is a particular type of validity – which is the extent that a measurement consistently gives the same result on different occasions. The significance of a measurement reliability is to obtain a standard index to evaluate the validity of the measurement.

The reliability of a measurement scale can be influenced by diverse factors among which are ability of people being measured, the method of measurement (pretest-posttest posttest-pretest, quasi design), length of the measurement and structure of reporting. The validity of a pretest-posttest can be compromised because of pretest sensitivity and response shift bias. The literature on validity theory has suggested certain widely used solutions to minimize the effects of pretest sensitivity and response shift bias. These solutions are to pay attention to the wordings of the measurement instrument, the retrospective pretest (posttest, before pretest) and the control group quasi experimental design. The first option is especially appealing in the research case study at hand because the e-skills measurement instrument is particularly inspired by the application of ICT to the workplace. This implies that the measurement instrument was designed to measure the specific e-skills relevant to the daily activities of CDWs, thereby improving measurement validity.

Results and Discussion
The pretest and posttest data formatted in Microsoft Excel format were uploaded to the IATA software for the estimation of IRT parameters. These parameters were supplied into a maximum likelihood algorithm for the determination of the e-skills levels of CDWs. The important results of this research case study and their discussions are presented in this section under the main headings of descriptive statistics, testing for validity and comparing e-skills levels.

Descriptive Statistics
The Microsoft Excel software was used for the descriptive analysis of frequency, mean, standard deviation, minimum and maximum values of responses.

Participant demographics
The statistics of the pretest data revealed that four coordinators, who were responsible for coordinating the activities of CDWs, participated in the research case study. The pretest sampling plan contained an uneven gender division of 206 female CDWs and 121 male CDWs. This uneven gender sample reflects the dominance of the female population over the male population in South Africa. The Statistics South Africa (Stats SA) 2013 estimated the mid-year population at 52.98 million with approximately 51% of the population was found to be female. The majority of the CDWs (262) work in rural disadvantaged areas, 53 of them work in semi-urban marginalized areas and 12 of them work in urban city advantaged areas.

Educational background
The 327 CDWs who participated in the pretest experiment had educational backgrounds in Grade 12, post-grade 12 education, NPDE and N6 Certificate. Specifically, 189 CDWs had Grade 12 qualification, 136 had post-grade 12 education, 1 had PDE and 1 had N6 Certificate. There were 192 CDWs who had some form of formal training in the use of computer systems and related
applications. There were 137 CDWs who had no formal computer training skills. There were 16 CDWs who claimed that they have “very competent” level of skills in using computer systems, 158 of them claimed to have “average” competence level, 134 of them claimed to have “low level of competence” and 19 of them claimed to have never used a computer system. It should be noted that this result included those CDWs who had no formal training in the use of computer systems, but may have had informal training.

Table 3 shows the number of CDWs who have competence using a particular software application on their computing devices - desktop computer, laptop and Smartphone. The majority (274) of the CDWs had used email applications, 201 of them had used word processing and 34 of them had never used any application. Table 4 shows the number of CDWs who have competence using a particular software application on their Cellphones or Smartphones. The majority (300) of the CDWs had used WhatsApp, but only 5 of the CDWs indicated that they had not used any cellphone. It is interesting to see that many CDWs had used Blackberry Messenger (BBM) and Google – which are both communication software that CDWs found useful to connect with stakeholders. The following additional educational information was collected from the participating CDWs:

a) The CDWs, when asked what they expected to gain from the pilot e-skills training. They mentioned that they expected to gain knowledge, to be able to write reports using computers, access computers, access the internet and they wanted to acquire computer and internet skills.

b) The CDWs when asked to state why they are participating in the pilot e-skills training, the majority of them wanted to acquire ICT knowledge (160 of them) while 58 of them wanted to acquire ICT skills (e-skills). The others simply said they wanted to gain more knowledge, improve their knowledge and gain computer skills. The summary of the need requirements of the CDWs is that many of them wanted to gain knowledge and skills pertaining to ICT.

<table>
<thead>
<tr>
<th>Software Application</th>
<th>Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>Word processor</td>
<td>201</td>
</tr>
<tr>
<td>Presentation software</td>
<td>84</td>
</tr>
<tr>
<td>Spreadsheet</td>
<td>90</td>
</tr>
<tr>
<td>Email</td>
<td>274</td>
</tr>
<tr>
<td>Management information system</td>
<td>26</td>
</tr>
<tr>
<td>Other</td>
<td>35</td>
</tr>
<tr>
<td>I don’t use any</td>
<td>34</td>
</tr>
</tbody>
</table>
Table 4: Number of CDWs who have Competence using Software Applications on their Cellphones or Smartphones

<table>
<thead>
<tr>
<th>Software Application</th>
<th>Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>WhatsApp</td>
<td>300</td>
</tr>
<tr>
<td>Facebook</td>
<td>194</td>
</tr>
<tr>
<td>Twitter</td>
<td>46</td>
</tr>
<tr>
<td>Blackberry Messenger (BBM)</td>
<td>281</td>
</tr>
<tr>
<td>Google</td>
<td>237</td>
</tr>
<tr>
<td>Other</td>
<td>34</td>
</tr>
<tr>
<td>I don’t use any</td>
<td>5</td>
</tr>
</tbody>
</table>

**Job requirements**

The job requirement information has to do with the daily tasks performed by the CDWs that require using ICT. The majority (221) of CDWs indicated that they phone people daily. Surprisingly, among those CDWs who phone people, at least monthly, 231 of them used ICT, but another 96 of them never used ICT besides the ordinary phones they used for communication purpose. It is interesting to discover that phoning people, providing information to individuals, searching the internet for information and sending messages to people of different groups are the predominant tasks of CDWs who participated in this research case study (Table 5). The majority (149) of CDWs indicated that they spent more than 50% of their time per day writing reports and 118 of them attended meetings (Table 6). The following additional job requirements information was collected from the participating CDWs:

a) The CDWs when asked to describe in a few words the specific area of job responsibility, the majority of them claimed that they assist in the development of the community by disseminating information, facilitating communication, coordinating community activities, relating government to communities and communicating government services to the communities.

b) The CDWs when asked to describe in a few words how the delivery of public services to communities has been improved in the last three years. They generally mentioned that there was improved access to government information and improved community development – in terms of road rehabilitation, provisioning of sanitation, houses, clean water, stable electricity and free basic services. In addition, they mentioned that there were skills development and a reduction in long queues often experienced in government departments.

c) The CDWs when asked to say what they think would be the benefits of using ICT in their jobs. The majority of them responded that ICT makes the job easier, improves communication, facilitates data capturing, supports report writing and improves job skills. In addition, they mentioned that ICT improves quality of work, provides easy access to relevant information, enables someone to acquire new knowledge and to develop one’s skills.
### Table 5: Frequency of tasks performed by CDWs using ICT

<table>
<thead>
<tr>
<th>Task Performed by CDWs</th>
<th>Daily</th>
<th>Weekly</th>
<th>Monthly</th>
<th>Never Performed Task</th>
<th>Use ICT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Write reports</td>
<td>12</td>
<td>41</td>
<td>249</td>
<td>25</td>
<td>307</td>
</tr>
<tr>
<td>Email people</td>
<td>88</td>
<td>117</td>
<td>71</td>
<td>51</td>
<td>327</td>
</tr>
<tr>
<td>Provide information to individuals</td>
<td>181</td>
<td>64</td>
<td>36</td>
<td>46</td>
<td>275</td>
</tr>
<tr>
<td>Talk to groups of people</td>
<td>100</td>
<td>134</td>
<td>45</td>
<td>48</td>
<td>252</td>
</tr>
<tr>
<td>Attend meetings</td>
<td>41</td>
<td>205</td>
<td>43</td>
<td>38</td>
<td>232</td>
</tr>
<tr>
<td>Phone people</td>
<td>221</td>
<td>43</td>
<td>23</td>
<td>40</td>
<td>231</td>
</tr>
<tr>
<td>Search for information</td>
<td>169</td>
<td>79</td>
<td>33</td>
<td>46</td>
<td>284</td>
</tr>
<tr>
<td>Provide forms for people to complete</td>
<td>43</td>
<td>97</td>
<td>117</td>
<td>70</td>
<td>212</td>
</tr>
<tr>
<td>SMS groups of people</td>
<td>115</td>
<td>108</td>
<td>54</td>
<td>50</td>
<td>251</td>
</tr>
<tr>
<td>Submit a budget or financial statement</td>
<td>25</td>
<td>23</td>
<td>97</td>
<td>182</td>
<td>48</td>
</tr>
</tbody>
</table>

### Table 6: Percentage of time spent per day on tasks

<table>
<thead>
<tr>
<th>Task Performed by CDWs</th>
<th>Less than 10%</th>
<th>10-30%</th>
<th>30-50%</th>
<th>50% and more</th>
<th>No Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>Write reports</td>
<td>25</td>
<td>56</td>
<td>83</td>
<td>149</td>
<td>14</td>
</tr>
<tr>
<td>Email people</td>
<td>81</td>
<td>68</td>
<td>101</td>
<td>54</td>
<td>23</td>
</tr>
<tr>
<td>Provide information to individuals</td>
<td>36</td>
<td>75</td>
<td>74</td>
<td>92</td>
<td>30</td>
</tr>
<tr>
<td>Talk to groups of people</td>
<td>55</td>
<td>67</td>
<td>91</td>
<td>86</td>
<td>28</td>
</tr>
<tr>
<td>Attend meetings</td>
<td>27</td>
<td>46</td>
<td>105</td>
<td>118</td>
<td>31</td>
</tr>
<tr>
<td>Phone people</td>
<td>60</td>
<td>69</td>
<td>77</td>
<td>97</td>
<td>24</td>
</tr>
<tr>
<td>Search for information</td>
<td>30</td>
<td>73</td>
<td>108</td>
<td>97</td>
<td>19</td>
</tr>
<tr>
<td>Provide forms for people to complete</td>
<td>81</td>
<td>75</td>
<td>78</td>
<td>57</td>
<td>36</td>
</tr>
<tr>
<td>SMS groups of people</td>
<td>72</td>
<td>82</td>
<td>78</td>
<td>70</td>
<td>25</td>
</tr>
<tr>
<td>Submit a budget or financial statement</td>
<td>150</td>
<td>31</td>
<td>13</td>
<td>16</td>
<td>117</td>
</tr>
</tbody>
</table>

### Technology infrastructure

The information collected on technology infrastructure includes computer devices and software applications often used by CDWs. The majority (312) of the CDWs had access to laptops, 244 of them had access to Smartphones, but only 52 of them had access to desktop computers (Table 7). The huge percentage of CDWs had access to laptops because recently the KZN province provided the CDWs with laptops and USB internet modems to enhance their ability to use ICT for service delivery. The majority (289) of the CDWs had access to the internet, but only 38 of CDWs had no opportunity to access the internet. The majority (119) of those CDWs who had access to internet indicated that the quality of internet connection was workable (Table 8). Moreover, the majority (164) of CDWs who had access to the internet indicated that they accessed the internet more than once per day, but 7 CDWs had no access to the internet (Table 9).
Table 7: Types of computer devices accessible to CDWs

<table>
<thead>
<tr>
<th>Device type</th>
<th>Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>Desktop computer</td>
<td>52</td>
</tr>
<tr>
<td>Tablet</td>
<td>24</td>
</tr>
<tr>
<td>Laptop</td>
<td>312</td>
</tr>
<tr>
<td>Smartphone</td>
<td>244</td>
</tr>
<tr>
<td>Others</td>
<td>17</td>
</tr>
</tbody>
</table>

Table 8: Quality of internet connection as experienced by CDWs

<table>
<thead>
<tr>
<th>Quality of internet connection</th>
<th>Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very fast</td>
<td>10</td>
</tr>
<tr>
<td>Fast</td>
<td>31</td>
</tr>
<tr>
<td>Workable</td>
<td>119</td>
</tr>
<tr>
<td>Slow</td>
<td>67</td>
</tr>
<tr>
<td>Very slow</td>
<td>43</td>
</tr>
<tr>
<td>Very reliable (never drops connection)</td>
<td>2</td>
</tr>
<tr>
<td>Mostly reliable</td>
<td>0</td>
</tr>
<tr>
<td>Does drop connection sometimes</td>
<td>15</td>
</tr>
<tr>
<td>Regularly drops connection</td>
<td>2</td>
</tr>
</tbody>
</table>

Table 9: Frequency of access to the internet by CDWs

<table>
<thead>
<tr>
<th>Frequency of internet access</th>
<th>Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>More than once per day</td>
<td>164</td>
</tr>
<tr>
<td>Once per day</td>
<td>61</td>
</tr>
<tr>
<td>Once per week</td>
<td>47</td>
</tr>
<tr>
<td>Once per month</td>
<td>10</td>
</tr>
<tr>
<td>Never</td>
<td>7</td>
</tr>
</tbody>
</table>

Testing for Validity

The test for validity of the pretest and the posttest response data was performed using reliability and convergent validity estimations. The convergent validity shows the extent to which items represent the same measurement and is measured using the standardized item loadings that should fulfil the 0.4 requirements (Kawashima & Shiomi, 2007). The reliabilities of the response data were found to be 0.95 for the pretest data (N=327) and 0.95 for the posttest data (N=189) (Table 10). In addition, the data mean scores were found to have improved from 23.53 for the pretest data to 62.17 for the posttest data, meaning that CDWs generally responded well after the training intervention. This improvement in the mean of response data is significant and it could be said that the e-skills training intervention had impacted significantly on the CDWs.
Table 10: Descriptive statistics of pretest and posttest measures

<table>
<thead>
<tr>
<th>Statistics of Pretest and Posttest Data</th>
<th>Pretest</th>
<th>Posttest</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>23.53</td>
<td>62.17</td>
</tr>
<tr>
<td>Standard deviation</td>
<td>22.84</td>
<td>25.39</td>
</tr>
<tr>
<td>Skewness</td>
<td>1.16</td>
<td>-0.66</td>
</tr>
<tr>
<td>Kurtosis</td>
<td>0.74</td>
<td>-0.32</td>
</tr>
<tr>
<td>Inter quarter range</td>
<td>29.83</td>
<td>33.33</td>
</tr>
<tr>
<td>P-25</td>
<td>5.26</td>
<td>47.37</td>
</tr>
<tr>
<td>Median</td>
<td>15.79</td>
<td>66.67</td>
</tr>
<tr>
<td>P-75</td>
<td>35.09</td>
<td>80.69</td>
</tr>
<tr>
<td>Reliability</td>
<td>0.95</td>
<td>0.95</td>
</tr>
</tbody>
</table>

Table 11 shows the mean, standard deviation and item loadings for each e-skills domain measured. The mean scores for the pretest data vary from the lowest (1.31) for item Q37 to the highest (2.34) for item Q39, meaning the CDWs generally responded below the average score of 3. This result is a reflection of the general low e-skills levels of CDWs, hence confirming the statement of coordinators that CDWs were generally at low e-Skills levels. In Table 11, the mean scores for the posttest data can be seen to vary from the lowest value of 3.12 (Q34) to the highest value of 3.63 (Q33). This result means that CDWs generally responded to each e-skills domain above the average score of 3. The item loadings are the same for both the pretest and the posttest data. These values vary from the lowest value of 0.42 to the highest value of 0.63, which fulfills the 0.40 requirements. This, therefore, provides an empirical evidence of acceptable convergence validity. Moreover, the reliabilities of data were found to be very high, which enabled us to further proceed with the analysis of the response data.

Table 11: Mean, standard deviation and factor loadings for items

<table>
<thead>
<tr>
<th>Code</th>
<th>Pretest</th>
<th>Posttest</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>Standard deviation</td>
<td>Loadings</td>
</tr>
<tr>
<td>Q25</td>
<td>1.98</td>
<td>1.00</td>
</tr>
<tr>
<td>Q26</td>
<td>2.30</td>
<td>1.05</td>
</tr>
<tr>
<td>Q27</td>
<td>1.70</td>
<td>1.01</td>
</tr>
<tr>
<td>Q28</td>
<td>1.57</td>
<td>0.88</td>
</tr>
<tr>
<td>Q29</td>
<td>1.88</td>
<td>1.10</td>
</tr>
<tr>
<td>Q30</td>
<td>1.60</td>
<td>0.92</td>
</tr>
<tr>
<td>Q31</td>
<td>1.43</td>
<td>0.79</td>
</tr>
<tr>
<td>Q32</td>
<td>1.77</td>
<td>0.96</td>
</tr>
<tr>
<td>Q33</td>
<td>2.04</td>
<td>1.10</td>
</tr>
<tr>
<td>Q34</td>
<td>1.43</td>
<td>0.81</td>
</tr>
<tr>
<td>Q35</td>
<td>2.00</td>
<td>1.14</td>
</tr>
<tr>
<td>Q36</td>
<td>1.59</td>
<td>0.89</td>
</tr>
<tr>
<td>Q37</td>
<td>1.31</td>
<td>0.66</td>
</tr>
<tr>
<td>Q38</td>
<td>1.54</td>
<td>0.84</td>
</tr>
<tr>
<td>Q39</td>
<td>2.34</td>
<td>1.14</td>
</tr>
</tbody>
</table>
Determining e-Skills Interventions

Comparing e-Skills Levels

The complementary application of CTT and IRT provided a robust analysis of e-skills levels of CDWs. Based on the estimated CTT and IRT parameters given in Table 12, we can see some improvement in the e-skills levels of CDWs. The pretest responses showed that only 16% (p-value=0.16) of CDWs responded well to item Q39 (I have the skills to facilitate mobile interaction between community members and government representatives using social media such as SMS, email and Twitter), while 2% (p-value=0.02) responded well to item Q37 (I have the skills to set up a financial budget using an electronic spreadsheet). The discriminations are very high for item Q39 (a=1.09) and item Q37 (a=1.97) respectively. The difficulties of the items are also very high Q39 (b=1.35) and Q37 (b=2.66). In fact, it can be seen generally that all items have very high discriminations ranging from 1.14 (Q29) to 1.97 (Q37), very high difficulty ranging from 1.39 (Q26) to 2.66 (Q37) and no pseudo-guessing as c=0 for all items. The direct implication of this result is that the majority of CDWs could not effectively use ICT to perform tasks in the workplace. These tasks, include, for instance, setting up a financial budget and facilitating mobile interaction between community members and government representatives. Moreover, there was a clear differential between the e-skills of those CDWs who were able to use ICT and those who were not. The posttest responses indicated that the e-skills training had generated significant impact on CDWs because their e-skills levels had improved significantly. The percentage of CDWs who responded to each item had increased after the training. The p-value, for instance, had risen from the range of [2%, 16%] to the range of [21%, 51%], which can be considered significant. In addition, the discrimination level had fallen from the interval of [1.14, 1.97] to [0.77, 1.18] and the item difficulty had decreased from [1.39, 2.66] to [-0.03, 1.38]. This result further indicated some improvement in the e-skills levels of CDWs as a result of the pilot training implemented in this research case study.

### Table 12: CTT and mIRT parameters that gave the best estimate of e-skills levels of CDWs

<table>
<thead>
<tr>
<th>Code</th>
<th>Discr</th>
<th>PVal</th>
<th>PBis</th>
<th>a</th>
<th>b</th>
<th>c</th>
<th>Code</th>
<th>Discr</th>
<th>PVal</th>
<th>PBis</th>
<th>a</th>
<th>b</th>
<th>c</th>
</tr>
</thead>
<tbody>
<tr>
<td>Q25</td>
<td>0.27</td>
<td>0.08</td>
<td>0.59</td>
<td>1.77</td>
<td>1.68</td>
<td>0</td>
<td>Q25</td>
<td>0.52</td>
<td>0.47</td>
<td>0.46</td>
<td>0.77</td>
<td>0.14</td>
<td>0</td>
</tr>
<tr>
<td>Q26</td>
<td>0.37</td>
<td>0.15</td>
<td>0.52</td>
<td>1.15</td>
<td>1.39</td>
<td>0</td>
<td>Q26</td>
<td>0.69</td>
<td>0.51</td>
<td>0.55</td>
<td>0.92</td>
<td>-0.03</td>
<td>0</td>
</tr>
<tr>
<td>Q27*</td>
<td>0.32</td>
<td>0.09</td>
<td>0.55</td>
<td>1.48</td>
<td>1.63</td>
<td>0</td>
<td>Q27*</td>
<td>0.68</td>
<td>0.41</td>
<td>0.52</td>
<td>0.95</td>
<td>0.31</td>
<td>0</td>
</tr>
<tr>
<td>Q28</td>
<td>0.12</td>
<td>0.03</td>
<td>0.47</td>
<td>1.89</td>
<td>2.23</td>
<td>0</td>
<td>Q28*</td>
<td>0.60</td>
<td>0.34</td>
<td>0.49</td>
<td>0.91</td>
<td>0.62</td>
<td>0</td>
</tr>
<tr>
<td>Q29*</td>
<td>0.35</td>
<td>0.12</td>
<td>0.51</td>
<td>1.14</td>
<td>1.60</td>
<td>0</td>
<td>Q29*</td>
<td>0.62</td>
<td>0.33</td>
<td>0.49</td>
<td>0.99</td>
<td>0.61</td>
<td>0</td>
</tr>
<tr>
<td>Q30</td>
<td>0.21</td>
<td>0.06</td>
<td>0.46</td>
<td>1.37</td>
<td>2.02</td>
<td>0</td>
<td>Q30*</td>
<td>0.62</td>
<td>0.35</td>
<td>0.48</td>
<td>0.96</td>
<td>0.55</td>
<td>0</td>
</tr>
<tr>
<td>Q31</td>
<td>0.13</td>
<td>0.04</td>
<td>0.41</td>
<td>1.40</td>
<td>2.31</td>
<td>0</td>
<td>Q31*</td>
<td>0.71</td>
<td>0.32</td>
<td>0.53</td>
<td>1.18</td>
<td>0.60</td>
<td>0</td>
</tr>
<tr>
<td>Q32</td>
<td>0.23</td>
<td>0.07</td>
<td>0.48</td>
<td>1.27</td>
<td>1.91</td>
<td>0</td>
<td>Q32*</td>
<td>0.69</td>
<td>0.38</td>
<td>0.49</td>
<td>0.87</td>
<td>0.46</td>
<td>0</td>
</tr>
<tr>
<td>Q33</td>
<td>0.32</td>
<td>0.10</td>
<td>0.53</td>
<td>1.25</td>
<td>1.65</td>
<td>0</td>
<td>Q33*</td>
<td>0.79</td>
<td>0.50</td>
<td>0.63</td>
<td>1.16</td>
<td>0.00</td>
<td>0</td>
</tr>
<tr>
<td>Q34</td>
<td>0.11</td>
<td>0.03</td>
<td>0.39</td>
<td>1.58</td>
<td>2.35</td>
<td>0</td>
<td>Q34</td>
<td>0.38</td>
<td>0.21</td>
<td>0.38</td>
<td>0.71</td>
<td>1.38</td>
<td>0</td>
</tr>
<tr>
<td>Q35</td>
<td>0.38</td>
<td>0.11</td>
<td>0.60</td>
<td>1.48</td>
<td>1.52</td>
<td>0</td>
<td>Q35</td>
<td>0.65</td>
<td>0.46</td>
<td>0.51</td>
<td>0.76</td>
<td>0.17</td>
<td>0</td>
</tr>
</tbody>
</table>
The asterisk (*) indicates the useful items with significant improvement after the post intervention.

The true e-skills levels of CDWs were estimated using a maximum likelihood algorithm (Equation 1 and Equation 2). The estimated e-Skills levels were placed on a 7-point Likert scale for easy interpretation and to easily determine the effectiveness of the pilot training. The result in Figure 4 indicated a significant improvement in the e-skills levels as the posttest curve is seen to increase above the pretest curve towards the upper edge of the e-skills scale. In particular, about 82% of CDWs were moderately skillful, while about 11% of them were somewhat skillful before the pilot training execution, which was generally unsatisfactory. This e-skills deficiency had significantly improved because about 18% of CDWs were somewhat skillful, 13% of them were very skillful and 20% of them were extremely skillful after the pilot training. The pilot training yielded an overall improvement rate of about 33%. However, it is interesting to discover that a certain group of CDWs (about 22% of them) was found to be extremely unskillful after the pilot training. The CDWs in this group needed a special attention as they were confused after the pilot training execution. They initially considered their e-skills levels to be moderate, but perceiving the nature of the training intervention, their self-efficacy considerably dropped and they became more confused. This kind of problem as observed in research case study, is generally referred to as response shift biased that was earlier mentioned. The CDWs may have changed their minds about the pretest scores in the post testing when they perceived the pilot training to be tougher for them. In a particular scenario, for instance, one training facilitator reported that certain CDWs were required to perform a simple financial analysis using the Microsoft Excel, but surprisingly, after they had entered the required financial data into the Excel, they used their calculators to calculate, instead of using Excel formulas. In this particular scenario, knowing that calculators should not be used complementary with a computer to perform a numerical computation reduced the self-efficacy of these CDWs.
Conclusion

The research case study here reported is a particular scenario of empowering CDWs in the KZN province of South Africa to enhance their delivery of community development services using ICT. The e-SI, COGTA and South African Local Government Association (SALGA) through a multi-stakeholder collaboration decided to address the e-skills deficiency among CDWs towards their empowerment. The first high priority consideration of these stakeholders was to develop the e-skills levels of CDWs to achieve the goal of empowerment. The KZN e-skills Co-lab was, therefore, tasked with the responsibility of implementing a pilot e-skills development training and to research on the effectiveness of the training. The critical task, therefore, for the Co-lab was to design, implement and evaluate a pilot training for CDWs as well as to recommend possible interventions towards a policy change.

The researchers at the Co-lab spent nearly seven months researching and collecting pertinent information as evidence to support the success or failure of the e-skills training. The researchers had a series of strategic planning meetings with the representatives of e-SI, COGTA and SALGA who were directly responsible for the affairs of CDWs. A preliminary research work was conducted, stakeholders were consulted and their recommendations were extensively studied. The general findings of this particular research case study and recommended decisions are summarized in this concluding section.

Findings

The general findings of this research case study can be summarized on the basis of the research questions that were examined during the research case study:

a) The CDWs mainly write reports and attend stakeholder meetings, which they do about 50% or more of their time (Table 5 and Table 6). If the CDWs mainly write reports about community development activities and projects as well as attend stakeholder meetings to provide feedbacks to the appropriate authorities about progress within their communities, then certainly they required more than the basic e-skills to be effective. They certainly required a more specialized software tool to aid them to efficiently keep adequate records, rapidly generate reports with less stress, support community activities as well as projects monitoring and evaluation. The CDWs cannot obviously perform
these complex activities using the basic e-skills to engage the application of ICT for improving effectiveness.

b) The studio training method with the aid of a Blackboard software helped us to practically improve the e-skills levels of CDWs. Since the goal of the e-Skills training was to shift the pretest normal curve around the moderate e-skills scale to the upper edge of the e-skills scale, the pilot training yielded a significant result, although further improvement is required (Figure 4). The majority of the CDWs (about 52%) improved in their e-skills levels after the pilot training implementation. The improvement result is impressive, however, some CDWs were found to have their e-skills levels extremely unsatisfactory. This group of CDWs was identified after the pilot training to need further attention.

c) The findings of this research case study have assisted us in arriving at a set of possible interventions for improving the effectiveness of community service delivery using ICT. These interventions are comprehensively discussed in the subsequent decision subsection.

Decision

The understanding of the nature of tasks performed by CDWs using ICT and the measurement of e-skills levels of CDWs have better positioned us to recommend some interventions. The decision that was followed to arrive at the recommended interventions was based on the following important criteria:

a) Feasibility – is the extent to which the intervention is economically viable to implement in order to solve the unique community service challenges.

b) Acceptability – is the extent to which politically or socially, the intervention is equitable, ethical, constitutional and the communities will be willing to accept the intervention as solving their unique community service challenges.

c) Effectiveness – is the likelihood that the intervention will accomplish the intended purpose of solving the unique community service challenges.

d) Sustainability – is the extent to which the intervention is sustainable in solving the unique community service challenges in the case that an unexpected event occurs. This is for instance, includes unavailability or insufficiency of resources to continuously fund the intervention.

The critical finding of this research case study is that a studio training intervention with the aid of ICT yielded a significant improvement in e-skills levels of CDWs. However, there are a number of factors that can inhibit the successful applications of ICT by CDWs, amongst which are the following:

a) The educational background of CDWs might limit them to rapidly grasp some of the important strategies that could help them build sufficient skills in the use of ICT.

b) The training duration might be too short for CDWs to master the rudimentary concepts that could help them to adequately apply ICT in the workplace.

c) The training costs might be too high to sustain the possibility of constantly training CDWs on the latest technology that they could use to improve their service delivery effectiveness.

The grounding of e-skills development in a program that expands the boundaries of knowledge beyond the basic ICT literacy will be instrumental to the success of CDWs. Intuitively, by ruminating on sustainability and costs of constant training, evolving and dynamic nature of ICT as well as other risk factors, we therefore, recommend the creation of a specialized community service delivery system to improve the effectiveness of public service delivery to communities. The three possible interventions to be considered in an open discussion are the following.
Determining e-Skills Interventions

a) Provide more frequent e-skills development training for community development workers to continuously improve their service delivery effectiveness.

b) Advocate for e-skills as a basis prerequisite for community development workers to seek employment in the public service.

c) Create a specialized innovative community service system to be used by community development workers to facilitate effective delivery of public services to their communities.

References


**Biographies**

**Oludayo, O. Olugbara** is with the Department of Information Technology, Durban University of Technology (DUT) in South Africa. He is a member of the Association for Computing Machinery (ACM) and the Computer Society of South Africa (CSSA). He is the Vice Chair of Space Science Research Group and Lead, Mobile and Wearable Computing in Emerging Service Economy (MOWECSE), Research Group at DUT. He coordinates the e-Skills research activities of the KZN CoLab at DUT. His research inclinations include Machine Learning, Computer Games, Image Processing, Grid/Cloud computing, e-Healthcare, e-Commerce, e-Government and Smart City Technologies.

**Richard Millham** is an academic in the Faculty of Accounting and Informatics in the Department of IT at Durban University of Technology. His research interests are in software and data evolution, big data, service oriented computing, and IT education (including e-learning)

**Delene Heukelman** has been a researcher for 14 years and has published a number of papers. Her main area of interest is User Interfaces and making them more accessible to users in general, but also specifically to non-English speakers and rural communities. As curriculum director of the eSkills Institute KZN CoLab she contribute towards the development of a national curriculum and competency framework for the eSkills Institute. As a senior staff member of the Department of Information Technology at the Durban University of Technology she plays a role in deciding the direction of the department and contributing towards improving all aspects of the department. She is passionate about promoting ICT within society to ensure that all South Africans can participate in the Knowledge Society with confidence.
Colin (Surendra) Thakur is Director at the KZN e-Skills CoLab which is tasked with e-skills education in general, and particularly on the e-enablement of government services for effective service delivery. He conceptualized and introduced InvoTech, an innovation incubator at DUT. Colin Thakur was the Chairman, Vice-Chair and National Treasurer for the years in worked with the KZN Computer Society of South Africa. He served on the Inaugural Complaints and Compliance Committee (CCC) of ICASA. Colin was commissioned by the IEC to undertake an international study of electronic voting (e-voting) practices completed in 2012 called “Electronic Voting – the cross-national experience.” Colin delivered 6 key notes on this topic, wrote five papers and was an international observer in the Zambian election. He will observe two e-voting elections.

Harold Wesso (Biography and photo not available)

Mymoena Sharif is the Chief Director of the Department of Communications iKamva National e-Skills Institute, a South African government initiative to advance and implement key e-skills interventions. She is a member of the Strategic Council for the United Nations Global Alliance on ICT for Development and is a former winner of the Bill & Melinda Gates International Access to Learning Award. She is co-author of the South African National e-Skills Plans of Action (NeSPA 2010 and NeSPA 2013).
Corporate Ethical Dilemmas during Global Expansion: Lessons for Corporate Governance and IT Professionals

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Abstract

This paper analyzes the ethical challenges that multinational enterprises (MNEs) face in the socio-cultural-legal context while operating in a cross-cultural business environment. The focus of this research is to examine how globalization, especially when enhanced or enabled by the corporate use of Information Technology (IT), has meaningfully influenced and changed corporate codes of conduct in US-based MNEs. The primary research question addressed by this study was, “How does globalization with catalysed by IT impact corporate codes of conduct?” Using detailed case study analyses of three large US-based MNEs with operations in Malaysia, we found that MNEs are likely to encounter a greater degree of difficulty in creating and implementing effective codes of conduct in a culturally diverse market. As far as corporate codes of conduct are concerned, one size does not appear to fit all for all markets. Codes need to address the social and cultural values and traditions of the region for to be effective. The study provided extremely interesting and culturally diverse viewpoints and attitudes toward existing corporate codes of conduct.

Key words: Role of Local Cultures, Global Institutions, Cross-Cultural Management, Social Issues, Corporate code of conduct, Information Technology Ethics.

Introduction

In an increasingly global business environment, multinational enterprises (MNEs) continually seek sources of competitive advantage. During this process, their business arms expand into new regions and countries, often with very diverse cultural backgrounds. It is our contention that the ethical capabilities of MNEs should also be counted as an important source of sustainable advantage, in addition to the traditionally acknowledged strategic, technological, financial, and organizational capabilities that they may possess. In general, a thorough understanding of the cultural bases for ethical behavior in both origin and host countries can enhance a business’s ability to succeed in a cross-cultural business environment. However, the alteration and reduction of both geographical and political borders as well as the growing interdependence of countries that are socially, politically, economically and legally diverse, have caused MNEs to revise many of their existing policies. If an MNE wishes to
operate effectively in a culturally diverse region it must first comprehend and consequently operate within the legal and moral frameworks of the host region. Many MNEs have their own ethical codes of conduct and these codes have often evolved within the socio-cultural background of the ‘origin’ nation, where the term origin in this instance refers to the MNE’s country of ‘belonging’ as perceived by the general public. While operating in a more diverse or culturally different region, it may not always be possible to follow the same practices – the more culturally diverse the region, the greater the challenges that MNEs are likely to encounter in the process of expanding their business footprint.

The objective of this paper is to analyze the ethical challenges that MNEs usually face in the socio-cultural-legal context while operating in cross-cultural business environment, and also to explore the impact of these challenges on operational efficiency. These challenges have been exacerbated by the rapid proliferation of Information Technology and its use a prime mover to bring about rapid globalization. It is argued in the paper that the cross-cultural differences create contradictions and paradoxes in several operational areas, particularly if the MNE fails to integrate local values and culture into its business practices – either in formal or informal ways. This, in turn, has the potential to create instability in its operations and can cast a shadow over long term sustainability. Case studies of three large US-based MNEs operating in Malaysia are used to support these arguments.

**Brief Background**

Ethics are an important aspect of doing business as it is commonly acknowledged that for the most part, globally responsible organizations do not exist solely for the purpose of making a profit or creating value for their shareholders. They also have responsibilities that are directed to a broader audience. ‘Corporate social responsibility’ is increasingly an area of concern for all organizations, whether they operate domestically or globally. Businesses that ignore ethical issues to expedite expansion of their operations may quite possibly face serious repercussions in the future. The problem assumes added significance for MNEs that operate in a cross-cultural scenario, where a diverse spectrum of ethical considerations needs to be accommodated.

Fisher and Bonn (2007) analyzed the tensions and challenges faced by the head office and the subsidiaries of MNEs when they operated in international markets. They observed that an organization’s approach to ethics depended on its own internal level of ethical behavior as well as the type of international strategy adopted. These two dimensions have the potential to create tensions between the head office of the organization and its and subsidiaries, which in turn could influence the organization’s ability to achieve its strategic goals. Payne et al. (1997) reviewed four international codes of conduct in an attempt to develop a single international uniform code that might be applicable to any business, in any country or culture. Schwartz (2005) suggested six universal moral values for corporate codes of ethics – trustworthiness, respect, responsibility, fairness, caring, and citizenship.

Kaptein (2004) analyzed the 200 largest corporations in the world and found that only 52.5 per cent had a code of conduct at all. More than half of these codes primarily describe corporate responsibilities regarding quality of products and services, adherence to local laws and regulations, and the protection of the natural environment. Many codes also made reference to principles governing stakeholder relations, appropriate conduct among employees and the treatment of company property by employees.

In a culturally diverse market, it is necessary for MNEs to effectively manage political and social forces in conjunction with the management of business forces. It has been argued that when perceived corruption in the business segment increases, MNEs maintain a safe distance from the government while bargaining. At the same time, MNEs that are less focused on ethics have a
greater likelihood of using social connections when dealing with the government (Luo, 2006). The differences between Asian values and Western values translate into ethical practices and translate into differences in business ethics (de George, 1997). A survey of senior managers of American-owned firms in China regarding their experience with China’s legal system and with intellectual property rights violations indicated that none of them found the system efficient and few found it fair. However, expatriate managers with experience in China have better insights into the functioning of the Chinese legal system and tend to be more satisfied with it than are less experienced managers (Guvenli & Sanyal, 2003).

Buller and McEvoy (1999) observed that MNEs can develop and sustain ethical capability through the related processes of transformational leadership, organizational learning, and human resource management. Barker and Cobb (1999) emphasized the importance of developing an international code of ethics and training expatriate managers to handle the cultural and ethical issues facing MNEs in culturally diverse regions. Ethics and the expectations within cultures affect all business transactions. It is vital for personnel in western MNEs to understand the expectations of their counterparts around the world (Pitta et al., 1999). This is especially true when many of these organizations have achieved a greatly enhanced global presence primarily through the use of IT, especially since the field of IT ethics is itself often new and yields a constantly evolving ethical landscape.

A number of MNEs have been the focus of intense ethical scrutiny over recent years. There are also instances where ethical violations by organizations in other, ‘non-home’ regions have been brought under legal scrutiny in their parent country. Olsen (2002) used three examples where oil and gas industry companies were prosecuted under US law for alleged human rights abuses and environmental degradation in places such as Ecuador, Nigeria and Burma. However, such cases are a drop in the bucket in comparison to the actual volume of violations that take place. Collingsworth (2006) further reviewed the effectiveness of such laws in the US and came to the conclusion that that existing legal provisions weren’t enough. MNEs themselves needed to take more concrete steps to ensure that their overseas operations were not implicated in human rights abuses.

Similarly, corruption distorts markets, undermines the rule of law, damages government legitimacy, and hurts economic development (Heineman & Heimann 2006). MNEs need to do more to discourage corrupt practices, particularly while conducting operations in developing countries that are hampered with weak corporate governance in the first place. In the long run, corruption is harmful and hinders the growth of host countries. It can also introduce inefficiencies in the system. MNEs that operate in regions where corruption is endemic have an obligation to refrain from illegal practices as defined by the law as well as by ethical standards (Rose-Ackermann, 2002). The OECD Convention on Combating Bribery of Foreign Public Officials in International Business Transactions also clearly states that corrupt practices such as bribery are no longer an acceptable standard for international competition in any country. MNEs that engage in international business must understand the provisions of the Convention and take steps to comply fully (Apke, 2001).

Interestingly, MNEs can also be victims of corrupt practices within a country. Using the example of Vietnam in its initial stage of liberalization, Maitland (2001) observed that as outsiders, MNEs were easy targets for corruption, along with different ethnic, religious and socio-economic groups.

**Methodology**

The research methodology used for this study was based on the use of multiple qualitative case studies. Three large US-based MNEs that had operations in South-East Asia were selected as case
study organizations for detailed analysis. Here, US-based essentially meant that the companies were headquartered in the United States and were generally recognized by the public on a worldwide basis to be ‘American’ companies. Many of these companies actually may have been incorporated in countries like the Cayman Islands, Panama, or other parts of the Caribbean for reasons of an advantageous tax posture. For the purposes of this study, these companies were still be considered to be US-based companies.

Many reasons also pointed to Asia as a reasonable choice for the locale for this study. Asian markets have shown remarkable growth in the past two or three decades, and today represent the fastest growing economic region in the world (UNCTAD, 2006). Many US manufacturing companies had their first brushes with the global arena when they first ventured into the largely unfamiliar South East Asian countries since 1970s. From the countries of South East Asia, Malaysia was selected as the focus point for some very significant reasons. First, Malaysia was in the forefront of much of the explosive economic growth witnessed by the South East Asian dragons in the 1970s, 1980s, and 1990s (UNCTAD, 2006). Second, due to some unique measures taken by the Malaysian government Malaysia was largely able to avoid the downturns precipitated by the Asian economic crisis of 1997-98 (Poon, 2000; UNCTAD, 2006). As a result, MNEs continued to do business in Malaysia during that period with very little disruption (Poon, 2000). Third, English is the generally accepted language of business in Malaysia, making it much easier for the researchers to conduct the study. Fourth, the multicultural and multiethnic (Malay, Chinese, and Indian) nature of Malaysian society provides an almost perfect cultural backdrop for this project. Sixty-five percent of Malaysian society consists of ethnic Malays, while 26% are ethnic Chinese and 8% are ethnic Indian. The remaining 1% is made up of other ethnic groups and indigenous peoples (Department of Statistics Malaysia, 2000). No other country in South East Asia (with the possible exception of Singapore) provides this multi-ethnic and multi-cultural demographic to such an extent.

Flexibility and diversity were the keys to the selection of organizations for case studies. Detailed research for the purposes of this study was conducted from 2005 – 2008 at three organizations operating in Malaysia. In each case, the researchers were required to sign confidentiality agreements that expressly forbade the use of the real name of the organization or any of its participants.

The first of these organizations (Company A) was involved in providing technology solutions and services to its customers worldwide. It possessed a long history of developing and selling innovative technology products and enjoyed a largely well deserved reputation for bringing quality products to market. In business in the United States for several decades, it possessed a well established corporate code of conduct and had close to three decades of operations in Malaysia with a substantial country presence in terms of employees.

The second organization (Company B) was a consulting company with clients in over 70 countries. The services provided by this company included the implementation of leading-edge technologies and the use of extensive business experience in order to assist customers identify new opportunities and seek improvements in business processes. Operations in Malaysia had been in existence for about 30 years and the country workforce was well over 500 employees.

The third organization (Company C) provided insurance and financial services to its customer base in over 100 countries. This company served its commercial, institutional and individual customers through extensive worldwide property-casualty and life insurance networks. The organization also provides retirement services, financial services and asset management services worldwide. Corporate operations in Malaysia were about 25 years old and it had over 1,000 employees in country.

Following Stake (1995) and Yin (2003) and their discussion of the best practices extant in qualitative case study analysis. The data collection for this research consisted of a combination of
methods outlined such as, documents, archival records, secondary sources such as company websites, and interviews. Documents and archival records included items such as the company’s internal policy and procedure manuals and Human Resources documents, as well as records of code of conduct violations.

Detailed face-to-face interviews were conducted with senior and middle-level executives of the three case study organizations. The numbers of respondents interviewed in the three companies were 12, 5 and 6, respectively. The initial interviews as well as several follow-up interviews and conversations were carried out over a period of two and a half years, during several visits to Malaysia by the researcher. The research made use of structured and unstructured interviews, conducted mostly face to face and to a small extent by telephone – the latter mostly when small points of additional clarification were sought. In most cases data obtained from preliminary interviews appeared to be the most revealing. A lot of information regarding the companies that were studied was readily available through secondary published sources such as annual reports and company websites. Companies that possess codes of conduct often tend to view them as public relations tools and make them readily available on their websites as well as through other published material. Information that could not be collected from secondary sources was sought from the source – the companies themselves.

Results and Findings

**Observed Business Practices with Respect to Code of Conduct**

Both Company A and Company B had an explicitly stated goal of good corporate citizenship in Malaysia. This was clearly presented on their local websites, as well as appropriate local company documents. Both companies also had detailed and comprehensive codes of conduct and underlying corporate philosophies that detailed company beliefs regarding conduct and ethics. Company A’s code, along with ancillary documents and policies, ran into well over a hundred pages and appeared to attempt to cover almost every contingency. Company B’s code, while not quite as long, was also very comprehensive and appeared to address most relevant areas (Kolk & van Tulder, 2005; Sethi, 2003). Interviewees in both Company A and company B were also largely of the opinion that their company’s philosophy toward conduct and ethics was sound, clearly stated, and detailed.

On the other hand, there was no mention of corporate citizenship on Company C’s local website, nor did the respondents at the company indicate that this was a clearly stated goal. In fact, many felt that their company did not possess a clearly stated and comprehensive philosophy towards conduct and ethics. By and large, they did not consider their company’s code to be particularly detailed or comprehensive and many considered it to be hurriedly put together, perhaps to serve as a public relations instrument.

Both the Company A and Company B codes of conduct were available in multiple language versions, while the Company C was available only in English. It is only fair, however, to point out that while both Company A and Company B codes were available in several languages other than
English, neither were available in Bahasa Malaysia, the language of the majority Malays in Malaysia.

Of the three companies, only Company B had a separate code of conduct specifically for Malaysia; however, respondents at Company B were quick to point out that the code for Malaysia was nothing other than the global code with a few cosmetic, and largely meaningless, add-ons. Thus, for all intents and purposes our conclusion was that none of the three companies studied had a true country-specific code.

All three companies required some sort of internal training and certification that their employees have read the code of conduct and that they understand it. In each of the three cases, this training and certification was administered using self-paced instructional software and had to be refreshed periodically or whenever there was a substantial modification of the code. To further lend credence to the conclusion above that the local Malaysian version of Company B’s code of conduct was in fact just a cosmetic adaptation of the global code, this training and certification at Company B in Malaysia was carried out only on the global code, and not on the local version.

All three company codes mandated penalties and sanctions for violations of the code. In all cases, these consequences, penalties, and sanctions were held to be confidential.

All three companies also provided secure and anonymous channels for employees as well as other stakeholders to report violations of the company’s code of conduct. In every instance, when such a report was made in good faith, the company codes of conduct made a promise to protect and to hold the reporters harmless from any adverse consequences that might result from making such a report. Respondents at all three companies indicated that the procedures that handled code violations did not take place internally within the Malaysian operations, but were instead handled by a global team.

There was general agreement among respondents at all three companies that little input, if any at all, had been sought from local employees to be used in the development or modification of the corporate code of conduct. Some employees at Company A had been surveyed regarding some aspects of the code of conduct, apparently with the stated intention of incorporating these viewpoints in future version of the code, but nothing along these lines had taken place to date. While Company B actually had a separate version of the code for Malaysia (largely dismissed by respondents as cosmetic) according to those interviewed within the company, none of the employees at Company B’s Malaysia operations had actually ever made any contribution to its development, which certainly makes the development of the separate version somewhat suspect. At Company C’s Malaysian operations, no input had ever been sought from local employees regarding any aspect of code development. In the case of every company, this was the cause of some resentment among many of those that were interviewed.

However, respondents at both Company A and Company B were generally favorable in their overall assessment of their company’s global code of conduct, describing it in largely positive terms such as ‘good’ or ‘fine.’ These reactions, although somewhat vague, have been reported verbatim, and seem to indicate the respondents didn’t appear to have a strong negative attitude toward the code. Reactions at Company C, however, were largely negative, with respondents often seeing the code as noting more than a public relations ploy by the company. In line with these reactions, respondents at A and B also considered their codes of conduct to be more effective than ineffective, barring inadequacies in dealing with local culture and constraints; while respondents at C considered their code to be mostly ineffective. Respondents in all three companies, however, considered that their codes generally did a poor job of handling conflicts or dilemmas that arose from specific differences between cultures.
When questioned about the training and certification process with respect to the code, respondents in all three companies considered many aspects of the training, especially some of the situational questions, to be irrelevant or out of context. Consistent with what appears to be a generally more critical attitude among its employees, respondents at Company C were somewhat more severe in their assessment of the ethics training scenarios that were in use at their company.

**Cross-Cultural Friction Relating to Codes of Conduct**

Criticisms of company codes of conduct that related largely to differences in cultural and national values were widespread at all three organizations that were studied. In every case respondents pointed out various aspects of their company’s codes of conduct that were inappropriate or ill-suited for circumstances in Malaysia. Some of the more important concerns that were voiced include the following:

- The code was a foreign (or western) code, developed by westerners for westerners and imposed willy-nilly on the local employees
- Local input was not sought, and if it was, it was generally ignored
- The code made no attempt to adequately handle differences arising from culture, location, or nation.
- Local entities were not permitted to handle code violations themselves, or locally
- The code made no allowances for the fact that Malaysia possessed a heterogeneous rather than a homogenous population
- The training used ethical scenarios that were inappropriate, out of context, or incomprehensible
- Local values and personnel were considered to be inferior; a ‘colonial’ outlook prevailed
- The importance of local customs was ignored
- The code was based entirely on ‘foreign’ values; local values did not play any part in its formulation
- The importance of meals, entertainment, and gift giving in Asia was either not understood or ignored
- Local holidays and festivals and their importance and significance were not taken into account
- IT related ethical violations formed a large segment of the incidents reported
- The code often was weakest in the area of IT governance

**Code Effectiveness**

The study also addressed the ability of company codes of conduct to effectively address certain specific issues. These issues were selected in accordance with findings from several researchers, including Kolk, van Tulder, and Welters (1999), Kolk and van Tulder (2005), Sethi (2003), and Jenkins (2001), who considered them necessary for effective codes of conduct in MNEs. Some modifications were made in order to align the questions to the specific needs of this study.

Based on secondary sources, all three companies appeared to have codes that effectively addressed employment related issues within their organizations. Respondents at all three companies supported this conclusion during the interview process, with only minor critical comments at A and B. At A, the company’s code of conduct regarding employment related policies were extended to cover employment agencies as well, and as a result some agencies refused to do business with A. Respondents at both A and B also mentioned the fact that the code made it difficult to employ or recommend friends and relatives for positions within the company. However, in general, respondents at all three organizations felt that their company’s code of conduct was effective in this area.
The codes of conduct of both A and B addressed employee training extensively – both code relat-
ed and career related. Responses from interviewees at both organizations supported this view.
Company C’s code of conduct, on the other hand, addressed code related training, but not career
related training. Nevertheless, employees at C indicated that they were largely satisfied with the
career related training they received at their organization.

Issues relating to working conditions were explicitly addressed in all three codes, and respondents
at all three companies expressed their satisfaction with how these items were dealt with within
their companies.

Company A, as the only manufacturing company in this study, did address the issues of industrial
relations within its code of conduct. Neither Company B nor Company C, with their non-
unionized workforces made any mention of this within their codes. Both A and B also addressed
the issues of forced labor and child labor within their codes of conduct and related policies,
whereas C did not do so. Respondents at C did not, however, consider this a major problem, since
they felt that local Malaysian legislation addressed these issues, and C did have an explicitly stat-
ed requirement in their code regarding compliance with local laws.

A and B have extensive sections in their code regarding the environment and corporate environ-
mental policy, while the code at C did not explicitly address these concerns. Respondents at all
three companies, however, indicated that there was an atmosphere within their companies that
encouraged environmental stewardship, although the emphasis appeared to be strongest at A and
weakest at C.

All three codes, to a greater or lesser extent, made mention of the health and well-being of their
employees. Some respondents at A considered A’s code in this area to be intrusive or irrelevant to
the local context, or to be excessively zealous. Company B employees were quite satisfied with
their code in this area, while some Company C employees considered that their code only did the
bare minimum in this area.

The area of stakeholder relations was addressed quite extensively by all thee companies in their
codes of conduct. Respondents at A and B acknowledged that the mechanisms for communication
with stakeholders were quite stringent, but did not have any complaints regarding the procedures.
Employees at Company C found the procedures to be overly restrictive, and some respondents
put forth the suggestion that recent scandals in the company’s US operations might be the reason
for the excessive caution.

The area of consumer interests elicited the largest number of comments at all three companies,
indicating that in this area, respondents at all three companies considered their code of conduct to
be inadequate. This was also seen in the last section, where many of the elements that caused
concern among the respondents related to this area. Almost all the responses in this area related to
customer relationship management and the importance of local culture and customs in this area.
Respondents at all thee companies were uniformly critical of their companies’ codes of conduct
and their handling of gifts, meals, entertainment, and the overall management of customer rela-
tionships.

Respondents at all thee companies expressed varying levels of dissatisfaction with their organiza-
tions in the area of community interest. While the codes of A and B explicitly addressed this area,
the code at Company C did not. However, respondents at A and B did not appear to be any more
satisfied than their counterparts at C, since they felt that there was a substantial difference be-
tween what the code set forth and what was actually achieved.

To deal with the area of global development, A and B have created extensive sections in their
codes of conduct. In addition, both these companies have signed the United Nations Global Com-
pact. Company C’s code of conduct does not explicitly address the area of global development,
but does mention it in its statement on corporate governance as a means for increased business opportunity. Company C is not a signatory to the UN Global Compact.

The codes of A and B are both particularly strong in the areas of ethics and fundamental human rights and freedoms, while that of C is considerably weaker. Respondents at A and B had strong positive feelings regarding this area in their companies’ codes, considering it to be a significant company asset. Employees at C felt that their code only minimally addressed this area.

Although all three company codes addressed the area of technology and its use, this was one of the weakest areas of the code. The codes at A and B addressed this area in a fragmented fashion, with items and issues scattered throughout the code, while the code at Company C consolidated all technology related items essentially into a single section.

Finally, all three codes of conduct addressed the legal obligations of the company and its employees. Respondents at all three companies were of the opinion that their codes of conduct adequately addressed this area.

**Analysis**

The information and findings presented above allow us to perform an analysis based on several dimensions, with significant implications for practice.

It certainly appears that MNEs tend to transplant their ‘home’ developed codes of conduct to other global locations. Extant literature had already indicated that this was possibly the case. The work of Sethi (2003), Jenkins (2001), Kolk (2005), Kolk, van Tulder, and Welters (1999), Kolk and van Tulder (2005) all indicate in greater or lesser degree that corporate codes of conduct are often developed in the ‘home’ country of the MNE and then either deployed verbatim or with minor cosmetic changes to most of the countries or regions that the company operates in. While they do not specifically single out US-based MNEs in these conclusions, there is certainly no reason to exclude them from these conclusions.

Responses from the interviewees in all three companies provide substantiation to these conclusions. The terms ‘foreign’ or ‘alien’ were often mentioned in the context of the codes of conduct, and sometimes terms as strong as ‘colonial’ were used. The latter is perhaps not surprising given Malaysia’s past history as a colony. Anecdotally, it appeared that the negative reactions were stronger among respondents who were (or appeared to be) older. Fewer of the younger respondents used the terms ‘foreign’ or ‘alien’ and none of them used the term ‘colonial.’ A possible reason for this could be that perhaps the younger, educated respondents are more ‘connected’ to a more homogenous global society.

The literature is relatively silent on the issue of seeking local input in the development of codes of conduct, although some mention is made by Sethi (2003) and Kolk and van Tulder (2005) regarding the importance of seeking such input if one is desirous of developing effective codes. However, responses from participants in this study would indicate that seeking local input is critical if the organization seeks a corporate code of conduct that is both effective in local situations as well as easily accepted by the people it is intended to guide. The latter is essential if the organization is to achieve the former, so the conclusion to be drawn here has great significance for organizations.

In this study, it was found that such input is either absent or minimal. The respondents at all three companies stated, and in many instances complained, that their input was either not sought at all, or, when it was sought, it was not used in the development or modification of their company’s code of conduct. Among many respondents, this was cause for resentment, and a sense that their input, opinions, and perhaps even their customs and culture were not considered important enough for consideration. The labels of ‘colonial’ mentioned in the previous answer relate directly to sentiments expressed by some respondents in this area.
The implication for MNEs is significant, since previous research indicates that effectiveness and acceptance are tied to the degree of local input sought in the development of codes of conduct.

A similar answer was reached with regard to implementation and enforcement of the code. Since extant literature does not address this issue, the answer to this question is derived entirely from responses elicited in the case studies. The evidence from the case studies strongly indicates that stripping local employees of the responsibility for implementing and enforcing the code of conduct (including the imposition of sanctions) causes resentment among employees and the furtherance of the view that the code is a ‘foreign’ instrument that has been ‘imposed’ on them without their consent.

In all three cases, the mechanics for handling code violations were carried out largely outside the Malaysian organization. Also in all three cases, the first steps in the process took place within the organizations, but only the very basic procedures were performed locally. These included the completion of Initial Incident Reports and in some cases, a preliminary investigation, but in all cases, the bulk of the process was handled by an external (usually US-based) team. The anonymous reporting process was also handled outside Malaysia, although in all three companies, employees did have the opportunity and facility to report violations and concerns to someone locally as well. However, once this was done, the process was then taken over by the external handlers. The answer to this question, therefore, is in the negative. Once again, the implication for the MNEs is significant, since the research indicates that effectiveness and acceptance are also linked to the degree of perceived autonomy in terms of implementation and enforcement by the local employees. This is another potential area for improvement for many MNEs.

Would Malaysian employees of US based MNEs be comfortable with a single universal code of conduct and would they consider such a code to be adequate for all the company’s worldwide operations? There was some degree of ambivalence in responses to this question, especially among the respondents from Company A and Company B. In both these organizations, employees were generally satisfied with many aspects of the code, and their overall impression was positive rather than negative. On the other hand, employees at Company C had a generally unfavorable impression of their company’s code of conduct, and many viewed it as more of a public relations tool used by the company to heal their battered image in the US rather than a true statement of intent. In all three companies, however, respondents did feel that the code was either inadequate, or poorly handled certain issues that related specifically to local customs, local culture, or the local population in terms of ethnic mix and other factors.

The logical conclusion to be drawn here would be that employees seek a code that has a commonality in the areas where such a commonality is appropriate, but one which is also tailored to accommodate differences brought about through culture, customs, language, and ethnicity. However, employees must perceive the code to be a true statement of intent, rather than a public relations tool in order to respect it. This implies that the views of many researchers regarding this issue may have to be rejected, since most of them call for a single code of conduct for MNEs, to be deployed across all countries of operation (Radin, 2004; Sethi, 2003). These researchers believe that separate codes of conduct for each country would lead to public relations nightmares and eventually to a loss of profitability, market share, and reputation.

Yet, this study indicated that such separate codes of conduct appear to be achievable with a relatively moderate effort, and would certainly lead to instruments that would be more accepted and consequently, more effective.

Respondents in all three companies reported that they were provided with adequate training on the codes of conduct. The frequency and breadth of the training was also considered adequate by the majority of respondents in all three organizations, although a few respondents felt that the frequency could be lessened. A common thread in all three organizations was that respondents
found certain aspects of the training to be inappropriate, irrelevant, or out of context. The cause, in each case, was attributed to the fact that the training tools, questions, and scenarios were developed for a US, or western setting. Thus, some of the context or questions were unfamiliar or irrelevant to the Malaysian employees.

It would appear that this situation could be easily rectified if local employees had greater input into code formulation and design, since the development of the training tools are also part of this same process.

Another perhaps surprising conclusion from the study indicates that, contrary to conventional wisdom, cultural differences in fact do not constitute a large obstacle in the creation and implementation of effective and appropriate codes of conduct.

As mentioned earlier, respondents at both A and B had a largely positive opinion regarding their codes of conduct. Company C employees didn’t have a positive opinion, but the negative opinion related to the entire code – they thought it was a bad code everywhere, not just in Malaysia. But irrespective of whether they considered the overall code in a good or a bad light, among respondents at all three organizations there was significant common ground in terms of the items that they thought should be changed in the code.

Most of the changes desired were rooted in local culture and customs and recognition and respect for differences that are found in these areas. Conduct and ethics are relative concepts and there is a huge body of work that supports this, including Hofstede’s classic work, researched and written over a quarter of a century ago (1980). It is our contention that it would be difficult indeed to have a single code of conduct that can be applied across all cultures and regions. Conduct, after all, relates to value systems, and those are not constant across the globe. Many of the issues listed above, therefore, could be addressed relatively easily by seeking local input and incorporating this input into locally implemented codes of conduct. Human values across the globe also have tremendous similarities, so these codes would of necessity have large areas of commonality. However, they could then be different where they needed to be.

The last item addressed here relates to national governance and legislative structures and their ability, or lack thereof, to keep pace with the rapid changes in the ethical and legal environments precipitated to a great extent by the process of globalization. We concluded from the case studies that in fact national governance and legislative structures are not able to keep pace. The literature is quite conclusive in that generally national governance and legislative structures are not able to keep pace with the rapid changes in the ethical and legal environments (Phukan, 1995; Phukan & Dhillon, 2000). Thus, it appears to be a continual case of closing the stable door after the horse has bolted. In all fairness, however, new ethical and criminal dilemmas and scenarios arise with such rapidity as globalization increases, that it is well nigh impossible for even the most dedicated and hard-working legislative bodies to keep abreast of the situation.

In this study, this was supported by the responses of the interviewees at all three companies. In almost every instance, respondents at all three companies felt that their corporate code of conduct did a better job of addressing relevant issues than current Malaysian legislation, a view supported by the research on local Malaysian conditions (Haniffa & Cooke, 2002; Yeoh & Mohd Razali, 2006).

This is not an unusual situation – and Malaysia is not alone. However, the relevance and importance of local governance structures in the development and fostering of corporate codes of conduct cannot be overstated. In every country, it is essential for the local legislative and corporate governance bodies to keep pace with the changing business environment in order to provide and adequate and effective framework for the development of corporate codes of conduct.
Conclusions

As we have seen, an ever increasing proportion of the world today is engaged in a globalized society. This conclusion is generally true for people as well as business organizations, large and small. This is not as new a phenomenon as some may think – history indicates that as peoples and cultures have migrated and traded with others, waves of globalization have ebbed and flowed. Trade routes across the Mediterranean, voyages of discovery seeking the fabled ‘spice islands,’ and the hunger for colonial empires, have all played their part in the march towards an increasingly interconnected and globalized world.

But the ‘Hot, Flat, and Crowded’ world of today (Friedman, 2008) is home to a scale of globalization that is greater than any that has been seen before, with a world that is interconnected to a degree and in a manner that would have been absolutely inconceivable to the world’s population perhaps even three or four decades ago. Consider this: Thomas Watson, president of IBM, once said, “I think there is a world market for maybe five computers” (Strohmeyer, 2009). Of course, he can probably be forgiven for this comment since he made it a little over 60 years ago – in 1943, to be exact, when the sum total of computing power in the world was less than what can be found today in a digital quartz wristwatch that costs less than US$ 10.

Current writing in the field offers considerable insight into globalization and there appears to be little doubt within the literature regarding the conclusions that globalization, with its opportunities and pitfalls, is here and that it is not likely to go away any time soon, if ever (Bhagwati, 2004; Sethi, 2003; Stiglitz, 2002). One important consequence of the process of globalization that does need to be addressed is the emergence of a large number of ethical questions and concerns, with an often bewildering variety in their scope. The literature discussed in the initial stages of this paper also conclusively indicates that MNEs are the primary agents for the globalization process as it currently stands.

The case studies indicate that MNEs that globalize and enter markets with cultural characteristics that are significantly different from their ‘home’ markets are likely to encounter a greater degree of difficulty in the creation and implementation of effective codes of conduct unless they are willing to accommodate local culture and customs in the development of these codes. There is little doubt that employees in all three organizations studies viewed their corporate codes of conduct as ‘foreign’ or ‘alien’ instruments to a greater or lesser degree. Even within the organizations that were viewed favorably by their employees as good corporate national and global citizens, this undercurrent of resentment relating to the imposition of a foreign code still existed. Training on code of conduct issues was also more difficult given the complications resulting from cultural differences. Anecdotally, the resentment appeared to be greater among older employees than among younger employees, but it was there nevertheless.

However, at least among organizations that enjoy a positive corporate citizenship image among their employees, it appears that substantial portions of their organization’s codes of conduct would be readily acceptable to their employees with little or no modification.

A logical conclusion to be drawn here would be that as far as corporate codes of conduct are concerned, one size perhaps does not fit all. Organizations would perhaps be better served by having different codes of conduct for different countries or perhaps different regions. This is contrary to almost everything the extant literature calls for, since most researchers (Sethi, 2003; Radin, 2004) are categorical in their belief that MNEs that operate in several countries cannot have separate codes of conduct for each country in which they operate. They insist that such a situation would be a public relations disaster, ultimately leading to loss of profitability, market share, and reputation. Our research, however, would disagree with such a conclusion. For corporate codes of conduct to be effective, they must be acceptable to the value-systems of those who are to be governed or guided by them. Thus, while corporate codes of conduct must incorporate universally accepted
values such as honesty, trust, fairness, respect for human rights and freedoms, respect for the environment, and adherence to contracts and agreements, they must also ensure that for each differentiated region or country in which they operate, the code addresses issues such as sovereignty of the nation, the economic goals of the country, and the social and cultural values and traditions of the region.

It is also apparent that in most cases changes in national corporate governance structures do not have either the speed or sufficiency to provide a meaningful framework for changes in corporate codes of conduct for MNEs operating within these countries. Respondents in all three organizations agreed that Malaysian legislation and corporate governance had not changed and grown quickly enough to provide a meaningful and employee friendly framework for the development of effective corporate codes of conduct that could be based on the country’s legal framework. The research indicates that this is largely true in most countries, although to a lesser or greater extent depending on the country. However, employees were also largely agreed that the codes of conduct of their respective organizations provided a more meaningful and secure system of protections than they might reasonably have expected from a local Malaysian company.

References


Biography

Sanjeev Phukan is a professor of Business Administration at Bemidji State University. He also serves as the university’s Director of International Relations and the Director of its MBA program. He received his MS in Management Science at BITS in India, his MBA at Illinois State University and his Ph.D. at Charles Sturt University in Bathurst, Australia. He serves as a visiting professor at universities in South Africa, Vietnam and Malaysia. He is the author of several research papers and publications, and his research interests include corporate governance and ethics in information technology.
ICT and Skills Shortage: South African Case Study of Retaining ICT-Skilled Professionals

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Abstract

South Africa is currently experiencing a shortage of an estimated 70,000 plus information and communication technology (ICT) professionals, which is compounded by the fact that the number of information and communication technology (ICT) graduates is now showing a decline. At an organisational level, the effective use of ICT for organisational information management is difficult without having appropriately ICT-skilled (e-skilled) employees. The shortage of e-skills in South Africa and much of Africa forces companies to work at retaining their existing e-skilled professionals, but this task is becoming increasingly difficult. Thus, this study established the objective to explore the factors that contribute to the retention of skilled ICT professionals in one international consulting organisation in South Africa, which also might bear relevance to other similar organisations operating in many other African countries. This study aimed to show that identifying these retention factors would lead to a better understanding of effective ways to retain much needed ICT-skilled professionals in organisations in South Africa. The findings of this study can help organisations in South Africa (and possible in other African countries) to formulate effective retention strategies and also provide a base for further academic research in this field. This qualitative exploratory research was done by reviewing the pertinent literature in order to identify relevant retention factors and the subsequent empirical testing of these factors. For that purpose, a single case study methodology was deployed, embracing three levels of ICT professional: consultants, managers and directors. The reviewed literature elicited 15 factors influencing the retention of e-skilled professionals. After testing these factors with 25 professionals at Company A, it was found that the following five factors are the most important when deciding to remain with the company or not: compensation, promotional opportunities, empowerment, interpersonal relationships, and personal well-being. This suggested that the ICT professionals in Company A are overwhelmingly driven by the need for reward and personal well-being, thus confirming that they predominantly belong to the Theory X type and, philosophically, to the Rational-Economic beings.

Keywords: ICT professionals, human resources, e-skills, retention, financial services.
Introduction

South Africa faces a major problem in its capacity to meet its challenges due to a substantial lack of e-skills and needs to develop a substantive integrated program to develop and retain these skills.

(e-Skills Summit, 2010)

Current literature suggests that the role of human resources (HR) crucially influences the organisational competitive advantage. Staff turnover has become one of the leading challenges affecting numerous organisations (e.g., Camps & Luna-Arcos, 2008; Kochan & Dyer, 1993) as staff replacement comes at very high cost (Bureau of Labour, 2010).

In South Africa, it is well-known that currently the country experiences a shortage of estimating over 70,000 ICT professionals. The fact that the supply side of the information and communication technology (ICT) graduates is now showing a decline makes the skills situation in South Africa even worse (Accenture, 2008; Birchwood Declaration, 2008; ITWeb, 2008; NeSPA, 2010). This general lack of ICT-skills (also referred to as e-skills) is seen by the National Government (notably, the Department of Communications) as a real impediment to South Africa meeting its commitment to building a Knowledge Society and executing the accepted international developmental programmes such as the Millennium Development Goals (MDGs) or the World Summit on Information Society (WSIS) Plan of Action. Information and communication technologies (ICT) related skills are also seen as crucial for the New Partnership for Africa’s Development (NEPAD) and the execution of the South African Medium Term Strategic Framework (MTSF) (DoC, 2007; Medium Term Strategic Framework [MTSF], 2009; NeSPA, 2010, 2013).

At an organisational level, the effective use of ICT for organisational information management is impossible without having appropriately e-skilled employees. Developing and retaining e-skills needed for business success is a requirement as the capable workforce is considered as a ‘powerful economic development tool’ (eSCC, 2004). It is then not surprising that the Human Resources (HR) strategy for many multinational organisations (such as the one described in this study) is to ‘leverage the global talent pool wherever it exists’ (Lanvin & Passman, 2008) i.e., to hire and retain already trained professionals who possess instantaneously usable and transferable e-skills.

However, the African continent as a whole is ‘on the move’ as the continent has been the second-fastest growing region in the world over the past decade (Fine et al., 2012). This fact and the shortage of e-skills forces companies to work at retaining the existing e-skilled professionals. In that regard, organisations inter alia offer ‘appropriate training, implement effective staff appraisal systems and review their promotion procedures in order to motivate and retain such workers’ (Mavromaras et al., 2010, pp. 24-25). Another reason for organisations trying to retain existing e-skilled professionals is the fact that skilling (required for obtaining employment), and often necessary up-skilling or re-skilling (required perform a particular job) is a costly endeavour (Wilson, 2008). Retaining highly e-skilled professionals is even more complex and can be more costly as these professionals are in high demand all over the world (Skills Australia, 2011). Yet another reason for taking care of the currently employed highly e-skilled personnel lies in the fact that ‘employers of ICT graduates find poaching and [so called] “brain drain” to be additional obstacles in acquiring and retaining suitably qualified ICT personnel’ (Calitz, 2010).

The situation in South African financial organisations, in general, and the international consulting company in Cape Town, which was the empirical setting of this study, in particular, is not much different. The researched organisation (here referred to as “Company A”) has vainly tried to derive strategy for retaining e-skilled professionals, i.e. employees who are capable consulting,
marketing, integrating, supporting and servicing ICT systems (NeSPA, 2010, 2013). Thus, this study sets the objective to explore the factors that contribute to the retention of e-skilled ICT professionals. It was deemed that identifying these retention factors would lead to better understanding of an effective way of retaining these professionals by appropriately managing these factors. This can help consulting organisations in South Africa, and possibly in Africa, in formulating future retaining strategy. Our intention also was to use this study to form a base for further academic research in this field.

**Approach to this Study**

This qualitative exploratory research, done in a setting where the researchers had little or no control over the events (Yin, 1994), was done by: (i) reviewing the pertinent literature and identifying relevant retention factors, thus helping this research to have ‘strong grounding in theory’ (MISQ, 2004), and (ii) the empirical testing of these factors in a consulting company. For that purpose the Case Study methodology was deployed in order to ‘capture data on the perceptions of local actors from within’ the researched organisation (Miles & Huberman, 1994: 6; Leedy, 1997).

The general conceptual approach to this study was based on the premise that the job satisfaction and staff turnover can have crucial impact on the HR management (HRM) and organisational performance. On the other hand, the HRM is directly responsible for hiring and retaining appropriately skilled staff in order to achieve organisational strategic objectives (Figure 1).

![Figure1: Relationships: HRM, Job satisfaction, Staff turnover and Organisational performance (Source: Authors, based on Mudor & Tooksoon, 2011)](image)

The research data for this project was gathered from participants across three employment levels: consultants, managers and directors and in their natural settings (Meredith, 1998). The data was gathered by conducting face-to-face interviews and disseminating a questionnaire. Twenty five (25) employees took part in the study – the sample that was considered as an appropriate representation of the ICT workforce within the ICT Risk department of Company A. This department was chosen as it contains the largest concentration of ICT professionals within Company A.

The Case Study approach to this research was selected in order to capture ‘multiple knowledges’ (Guba & Lincoln, 1994, p. 113) by collecting as reliable evidence as possible in order to create a narrative description of the situation being studied (Remenyi et al., 1998). In particular, the aim of this study was to expand understanding concerning the retention of ICT professionals in a financial consulting organisation – thus helping managers to create and execute an appropriate retention strategy. It is deemed that, in doing so, Company A would be able to retain its capability to effectively support its clients. The data collection was done through the questionnaire and interviews involving 25 respondents from the researched organisation. The questionnaire laid a good foundation towards getting and insight regarding the participants’ perceptions of employment levels, with regards to the staff retention challenges within the organisation. This was followed by 25 semi-structured interviews, which has given the authors more substantial understanding of the researched topic.
This paper is further structured as follows: the next section depicts the retention factors found in the pertinent literature; this is followed by the presentation of the empirical findings in the ICT Risk Department of Company A; the paper ends with the concluding remarks and recommendations.

The Retention Factors Elicited By the Reviewed Literature

It is believed that an organisation’s competitive approach in so called ‘Information Age’ inevitably depends on information, knowledge, ideas and management skills - thus resulting in the development of a new corporate paradigm highly dependent on employees and their skills (Gaylard et al., 2005). This paradigm shift caused that the ability to retain skilled staff becomes a strategic competitive business advantage. The successful organisational connections among their systems, strategies, support and clients are human drivers that are nowadays strategically connected (Cook & Jaggers, 2005). The reviewed literature suggests that the personnel retention studies can be divided into two groups: (i) those favouring money and monetary incentives as the only significant motivator for workers (e.g., Brooke, 2003), and (ii) those claiming that personnel is motivated by satisfaction of their internal needs (e.g., Hofes-Alfeis, 2008). The research done in the South African context (Greenfield, 1993) favours the former approach stating that the vast majority of South African workers are motivated by money or material rewards rather than achievements, self-efficiency and the path of one’s own behaviour. With reference to how the productivity of the workers could be increased, the results of Greenfield’s (1993) and Brooke’s (2003) studies confirmed that 96% of the companies surveyed believed that money was the most important motivating factor.

In order to examine the above hypotheses, the authors have explored a number of theories and models dealing with the retention of skilled workforce: for example, “Gender Principles”, “Human Resource Management Approach”, “Isolating factors”, “Employee Retention”, “Retention Theories”, “Retention drivers: four philosophies of human nature”, “Employee motivation”, or “Historical perspectives of employee motivation”. The aim of this endeavour was to identify the common retention factors and test their validity in the researched company. The factors educed from these theories and models are given in Table 1.

<table>
<thead>
<tr>
<th>Theory/Model</th>
<th>Factors</th>
<th>Authors</th>
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<tbody>
<tr>
<td>Gender Principles</td>
<td>• Needs Principle</td>
<td>Adam, 2005</td>
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<td></td>
<td>• Socially Perceived Principle</td>
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<td></td>
<td>• Cultural issues and values</td>
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<td>Human Resource Management Approach</td>
<td>• The motivational process</td>
<td>DeMers, 2002</td>
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<td></td>
<td>• The interaction process</td>
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<td></td>
<td>• The visioning process</td>
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<td></td>
<td>• The learning process</td>
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</tr>
<tr>
<td>Isolating factors</td>
<td>• Location of the company</td>
<td>Ramlall, 2003</td>
</tr>
<tr>
<td></td>
<td>• Compensation</td>
<td>Moncarz et al., 2008</td>
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<tr>
<td></td>
<td>• Challenging and interesting job</td>
<td>Walsh and Taylor, 2008</td>
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<td></td>
<td>• Company’s reputation</td>
<td>Clardy, 2005</td>
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<td></td>
<td>• Career development</td>
<td>Denton, 1994</td>
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<td></td>
<td>• Job security</td>
<td>Jike, 2003</td>
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<tr>
<td>Theory/Model</td>
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<td></td>
<td>• Training and development</td>
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<td>• Participation in decision-making (Empowerment)</td>
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<td>• Attractive benefits</td>
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<td></td>
<td>• Promotional opportunities</td>
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<tr>
<td>Extrinsic motivators</td>
<td>• Pay</td>
<td>Kaliprasad, 2006</td>
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<td></td>
<td>• Comfortable and safe work environment</td>
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<td></td>
<td>• Competence of leadership and resource provision</td>
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<tr>
<td></td>
<td>• Money</td>
<td>Spector, 2000</td>
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<tr>
<td></td>
<td>• Company shares</td>
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<td></td>
<td>• Profit sharing as extrinsic factors</td>
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<td></td>
<td>• Well-balanced workforce,</td>
<td>Lall, 2001</td>
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<td></td>
<td>• Policies</td>
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<td>• Rules</td>
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<td></td>
<td>• Skills investment</td>
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<tr>
<td>Intrinsic factors</td>
<td>• Worker’s behaviours</td>
<td>Wilson, 2008</td>
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<td>• Worker’s competencies</td>
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<td>• Expectations</td>
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<td>• Beliefs</td>
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<td></td>
<td>• Morale values</td>
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<td></td>
<td>• Job restructuring</td>
<td>Hofes-Alfeis, 2008</td>
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<td></td>
<td>• Co-worker relationships</td>
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<td></td>
<td>• Knowledge</td>
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<td></td>
<td>• Job insecurity</td>
<td>Lee-Kelley et al., 2007</td>
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<td></td>
<td>• Job satisfaction</td>
<td>Griffeth et al., 2000</td>
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<td></td>
<td>• Loyalty</td>
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<td></td>
<td>• Job turnovers</td>
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<td></td>
<td>• Knowledge retention</td>
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<tr>
<td>Employee Retention Constitutes</td>
<td>• Rewarding employees for effective job performance</td>
<td>Cascio, 2000</td>
</tr>
<tr>
<td></td>
<td>• Ensuring good working relationships between management and employees</td>
<td>Heneman and Judge, 2003</td>
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<tr>
<td></td>
<td>• Maintaining a safe, healthy working environment</td>
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<tr>
<td>Traditional Retention Approach</td>
<td>• Employee orientation and integration</td>
<td>Kaliprasad, 2006</td>
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<tr>
<td>(Include Trait Theory, Environmental Theory)</td>
<td>• Career planning and development</td>
<td>Banerjee, 1995</td>
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<td></td>
<td>• Employee relations</td>
<td>Muchinsky, 1990</td>
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<td></td>
<td>• Motivation</td>
<td>Sadri and Tran, 2002</td>
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<td></td>
<td>• Performance management</td>
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<td></td>
<td>• Training and development</td>
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<td></td>
<td>• Promotional opportunities</td>
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<td></td>
<td>• Compensation and benefit programs</td>
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<tr>
<td>Retention drivers: four philosophies of human nature</td>
<td>• Workers as rational-economic beings</td>
<td>Beck, 1983</td>
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<td></td>
<td>• Workers as social beings</td>
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<td>• Workers as self-actualising beings</td>
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</table>
Selection of the Relevant Retention Factors

The review of the pertinent literature showed that no-single theory or model encapsulates all retention-related factors. Analysing the above given factors, it is concluded that they can be grouped into particular clusters, as shown in Figure 2.

Since these factors are compiled from different theories and models, it was named as a ‘Mixed theory model’, which served as a conceptual model for testing highly e-skilled staff retention perceptions in the Company A (Table 2).
### Table 2: The selected retention factors for testing in Company A (Source: Authors)

<table>
<thead>
<tr>
<th>Factor</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Location of the company</td>
<td>Ramlall (2002)</td>
</tr>
<tr>
<td>Compensation</td>
<td>Zhao and Kay, 2008; Johnson, 2010</td>
</tr>
<tr>
<td>Challenging and interesting job</td>
<td>Walsh and Taylor, 2008</td>
</tr>
<tr>
<td>Company’s reputation and stability</td>
<td>Spector, 2000; Zuber, 2001; Clardy, 2005; Ongori, 2007</td>
</tr>
<tr>
<td>Personal well-being</td>
<td>Kaliprasad, 2004; Vather, 2008</td>
</tr>
<tr>
<td>Job security</td>
<td>Ramlall, 2004</td>
</tr>
<tr>
<td>Job satisfaction</td>
<td>Spector, 2000; Michaels, 2010</td>
</tr>
<tr>
<td>Job turnover</td>
<td>Griffeth, 2000</td>
</tr>
<tr>
<td>Training and development</td>
<td>Denton, 1994; Michaels, 2010</td>
</tr>
<tr>
<td>Participation in decision-making (Empowerment)</td>
<td>Ramlall, 2004; Jike, 2003</td>
</tr>
<tr>
<td>Promotional opportunities</td>
<td>Ramlall, 2004</td>
</tr>
<tr>
<td>Employee rewards</td>
<td>Gustafson, 2002; Heneman &amp; Judge, 2003; Johnson, 2010</td>
</tr>
<tr>
<td>Working conditions</td>
<td>Zuber, 2001; Kaliprasad, 2004; Hart et al., 2007</td>
</tr>
<tr>
<td>Interpersonal relationships</td>
<td>Spector, 2000</td>
</tr>
<tr>
<td>Personal growth and development</td>
<td>Tran, 2002</td>
</tr>
</tbody>
</table>

**Figure 2: “Mixed theory” retention model (Source: Authors)**

![Mixed theory retention model diagram](image-url)
The selection of the retention factors for the presented model was based on two criteria: (i) their commonality in the reviewed literature and (ii) manageability:

**Location of the company** – This factor as described by Ramlall (2003) and viewed as most suitable to be managed through the provision of personal benefits such as individual offices or related monetary benefits (e.g. travelling allowance).

**Compensation** – This is regarded as one of the most notable factors towards retaining staff (Moncarz et al., 2008). Managerial emphasis should be on ensuring a competitive wage system aligned to performance, standard of living, and level of employment.

**Challenging and interesting job** – Walsh and Taylor (2008) noted that most employees committed to performing challenging work within challenging and conducive working environments, are the employees that are most likely to remain. Therefore, management should implement and facilitate well-structured rotation procedures and work processes, continuously enrich work tasks, promote intense working arrangements and promote cross-sectional working tasks.

**Company’s reputation** – With reference to the Herzberg Theory (Spector, 2000), a positive relationship between organisation’s image and employees’ satisfaction is crucial towards retaining staff (Clardy, 2005). Reputation is at best managed when organisations fulfil all their commitments and promises made to employees in terms of welfare and working conditions and to clients in terms of the quality of services delivered.

**Personal well-being** – Satisfaction of employee’s personal needs is crucial towards retaining employees. As discussed by the Maslow’s Hierarchy of Needs Theory, people are never completely satisfied on any given need level, thus it is difficult for management to coordinate the personal well-being of an employee. Maslow states that the best way to manage this factor is to first determine what the employee’s needs are, then satisfy those needs, and thereafter all external factors will be satisfied by the employee.

**Job security** – Affiliated to the Maslow’s Hierarchy of Needs Theory and McGregor’s X/Y Theory, job security is an exceptionally strong factor and is properly and well managed through the provision of sustainable and beneficial employment contracts and well-organised working conditions and environment.

**Job satisfaction** – As prominently explained and initiated through the Herzberg Two-Factor Theory and the assistance of various researchers and their research, it is widely accepted that competitive compensation structures, beneficial promotional opportunities, well-balanced employee benefits, effective career development initiatives and good working conditions are the most essential elements to properly coordinate in order to enhance job satisfaction among employees.

**Job turnover** – Griffeth et al. (2000) maintain that job turnover is best managed through the relationship of pay and performance (higher the performance, higher the pay). Provision of various reward structures is vital, as is the creation of social community that will enhance social ties between employees.

**Training and development** – Training and development (T&D) is considered a life-long learning provision approach (Denton, 1994). There are various avenues that are regarded as best T&D approach, but the most effective and efficient managerial approaches to T&D are in the forms of: (i) basic skills enhancements (improve and enhance internal skills, by cross-sectional training); (ii) targeted education, training or counselling (educative workshops, extra training courses and career counselling session); (iii) college and university options (improved skills and qualifications to improve living standards and satisfaction).
Participation in decision-making (Empowerment) – In relation to Ramlall (2003) and the base provided by Jike (2003), decision-making participating efforts enhance performance and are well-managed through initiative exhibition sessions and also personal input in major decisions and discussions.

Promotional opportunities – In correlation with job satisfaction, it is concluded that critical factors such as structural career opportunities, intrinsic job rewards and recognition were necessary to mitigate the risk of losing employees through unrealistic promotional processes (Ramlall, 2003). More specifically, the importance of moving the mature professional to a job which enables their experience, maturity and skill which have been developed over the years to be put into practice. Doing more applied, generalist work would provide more feedback, more sense of task identity, more variety and more feeling of task significance, all of which are critical in enriching a job and creating a sense of promotion.

Employee rewards – The reviewed literature has shown that rewards as provided by organisations are closely linked to job satisfaction, and that it helps to motivate and retain competitive staff. Heneman and Judge (2003) argued that for organisations to retain its ICT staff, rewards must be matched to preference (match between rewards desired by employee and offered by the organisation).

Working conditions – Relating to the Herzberg Theory (Spector, 2000) and interlinked to job satisfaction, working conditions are well-managed through the provision of flexible working hours, a fun working environment, ideal workspace and positive self-fulfilment.

Interpersonal relationships – With reference to Alderfer’s ERG Theory and Herzberg’s Theory, relatedness is at most well-managed when management go beyond their job requirements to directly engage with staff members, share tasks among staff members, assign a peer to staff members if needed (e.g. development facilitating process), and invest in relationship building (social gathering).

Personal growth and development – Based on individual perception and motivation, personal growth and development are dependent on the employee ability to self-manage and facilitate that growth. Sadri and Tran (2002) state that the most proper ways to handle the process are to improve career planning, provide a supporting work environment, and by helping the employee balance career and family issues by clarifying his or her priorities.

Empirical Findings

The factors described above were presented to the respondents from Company A and they were asked to rank the factors according to their perception of importance. They were also asked to add to this list any other factor they deemed important for retaining ICT-skilled (e-skilled) professionals. Table 3 provides an indication of which factors were perceived to motivate the employees within the ICT Risk department to continue or end employment at Company A.
Table 3: The participants ranked e-skills retention factors in Company A

<table>
<thead>
<tr>
<th>Importance ranking</th>
<th>Retention factor</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Compensation</td>
</tr>
<tr>
<td>2</td>
<td>Promotional Opportunities</td>
</tr>
<tr>
<td>3</td>
<td>Empowerment (Participating in Decision Making)</td>
</tr>
<tr>
<td>4</td>
<td>Interpersonal Relationships</td>
</tr>
<tr>
<td>5</td>
<td>Personal Well-Being</td>
</tr>
<tr>
<td>6</td>
<td>Job Security</td>
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<tr>
<td>7</td>
<td>Employee Rewards</td>
</tr>
<tr>
<td>8</td>
<td>Job Turnover</td>
</tr>
<tr>
<td>9</td>
<td>Personal Growth and Development</td>
</tr>
<tr>
<td>10</td>
<td>Job Satisfaction</td>
</tr>
<tr>
<td>11</td>
<td>Challenging and Interesting Job</td>
</tr>
<tr>
<td>12</td>
<td>Training and Development</td>
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<tr>
<td>13</td>
<td>Working Conditions</td>
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<tr>
<td>14</td>
<td>Company’s Reputation</td>
</tr>
<tr>
<td>15</td>
<td>Location of Company</td>
</tr>
</tbody>
</table>

The elaboration for prioritisation of these employee retention factors was as follows:

**Compensation**

The study found that compensation factors (salary and bonuses) had the most influence on all the participants of the study, irrespective of their employment level. However, this factor also sparked some controversies. For example, at a director’s level compensation was perceived as one of the top retention factors since they also receive bonuses as per their profit share. But this type of compensation was perceived by other management levels as a problem since these categories of respondents believe that ‘directors just review the work but we put in all the hours and they get paid far more than us’... and ‘directors don’t consider the financial needs of lower levelled employees’. On the other hand, the respondents were not decisive whether decreased compensation would motivate them to leave the company.

It is noticeable that this finding confirms that the South African workforce predominantly belong to the Theory X type and, philosophically, to the Rational-Economic beings theory (Greenfield, 1993).

**Promotional Opportunities**

Company A is a growing organisation with professional promotional opportunities, and offers realistic promotional options. It was, however, found that the promotion process was properly understood only at directorial and senior managerial levels. The interviewed consultants were not sufficiently familiar with the promotional process thus deemed it ‘inconsistent and non-transparent’. The promotions process is seen by the upper managerial level as a ‘strategic tool’ and perceived to be professionally documented. They, however, admitted that it might be ‘poorly
communicated to employees’ as some employees ended their employment due to poor promotional decisions.

**Empowerment (Participating in Decision Making)**

Most of the managers and all of the consultants believe that most of the time they are excluded from structural and strategic decisions, which in turn affects their working performance. Despite the company’s top management denying it, the managers and consultants feel that this top-down decision-making approach at Company A allows directors to ultimately ‘filter’ decisions. Thus, managers and consultants feel somewhat unappreciated and inferior, which might lead to them leaving the company. This suggests that significantly involving the ICT-skilled professionals in the decision-making processes would improve their sense of contribution towards the company’s goals – thus, increasing their wish to stay with the organisation.

**Interpersonal Relationships**

Most interviewees feel that the relationship between employees (regardless of the level) is inadequate. They argued that this might be due to the fact that ICT Risk department is a merger between two legacy departments at Company A. This indicated a need for an organisational culture shift and different working styles. The interviewed consultants also believe that the directors and senior managers are generally too busy to communicate with lower levelled employees. This causes, they believe, poor performance feedback, and perceived superior attitudes by management towards lower level staff. This makes them feel very inferior, thus developing a sense of resentment towards managers, and especially directors. The directors’ and managers’ ‘superior attitude’ towards them might prompt the consultants to think about leaving the company.

Here is significant the appearance of two additional factors that might have a bearing on the Company A’s workforce retention decision-making: culture and communication. These factors, not explicitly mentioned in the reviewed literature, will be discussed shortly.

**Personal Well-Being**

All interviewed employees felt they needed to be treated with respect at their workplace and a lack of respect, therefore, will generally interfere with their working relationships with others. Directors and managers felt that lower level staff do treat them with respect when it is work related, but socially they perceive lower level staff as somehow distant and unapproachable. This situation is related to employment hierarchy, since lower level personnel (mainly consultants) feel intimidated and inferior to directors and managers: ‘We don’t feel comfortable in the presence of directors and managers, and therefore we ignore them to an extent. This is due to the fact that they present superior attitudes towards us’. Consultants also argue that management is not very supportive of them generally, and it is mostly the consultant’s task to approach management to inquire about their professional progress and well-being. Since this factor was ranked 5th most significant retention factor, it is highly important to appropriately attend to the employees’ well-being as many of the respondents stated that they will leave the company if they are not treated with respect regarding their professional and personal progress.

**Job Security**

The future and progress are very important factors when working for a financial institution - especially when an employee is still in the training phase, when permanent employment is still uncertain. Therefore, employment security is a very important factor for most of ICT Risk
consultants. On the other hand, directors and managers stated that they are satisfied with the employment contract and the overall employment security that Company A offers.

Apart from security and contracts, most managers are not satisfied with the performance feedback process, which sometimes impacts on professional development and delayed promotional opportunities - thus, influences a job security. The interviewed consultants feel that top management is often more focused on the business than on the professional development of staff. They feel that there is no formal and concrete communication between the employees and the Human Resources regarding contract negotiations and performance feedback, which influences their perception of job security. This makes job security one of the most probable retention decisive factors for e-skilled employees at Company A.

**Employee Rewards**

Employee rewards is a sensitive issue which involves great debate at Company A every year, but still does not deliver the expected results to the consultant level employees. While the interviewed directors and managers have pointed out the significance of this retention factor, the consultants believe that, due to the improper work timescales, they dedicate a lot of their free time to work but are not authorised to charge overtime: ‘Management plans and requires the work when they please regardless of what one’s workload is like, which is unfair’. The interviewed consultants are also becoming frustrated with the fact that Company A continually expects them to acquire new skills, and it is not clear whether this is considered in the salary review process. Furthermore, the interviewed consultants experienced that employee rewards in the form of bonuses are reserved for selected top performers, which creates a spirit of unfair employment and progress. They believe that their performance can be affected by an array of occurrences outside of their control but these occurrences are not considered when Company A does its performance reviews.

**Job Turnover**

The study found that at a director’s level the job turnover factor is of minimal concern since their compensation levels are directly linked to the firm’s financial situation and not solely their individual performance. Apart from their compensation, directors are not required to do unpaid work. They have indicated that their compensation is ‘sustainable’ - thus prompting them to stay rather than to look for new job opportunities. On the other hand, job turnover as a retention factor is more important to the interviewed managers since their performance is directly linked to their compensations. In order to avoid the job turnover, many of them have to undertake ‘underpaid’ work. This was similar for the interviewed consultants. They stated that they are forced to work on unpaid jobs as ‘the work needs to be completed even if budget was reached’. This challenge causes an unfavourable situation on a director and management level, which results in unwonted job turnovers. The fact that Company A finds it difficult to retain employees on a consultant level, partially due to this factor, gives this factor a significant prominence.

**Personal Growth and Development**

Company A offers good career planning initiatives regarding the career and skills development. For example, there are a number of courses offered in this regard. However, the main problem appears to be the situation when most employees sign up for these courses but ‘never get the chance to attend these courses’. This causes a delay in the employees’ skill development and minimises their opportunities to ‘get exposed to different working tasks and also promotional opportunities’.

Growth and development structures are in place at Company A, but it is the responsibility of the employees to drive their own growth and progress (though with the guidance of a mentor). This
particularly frustrates employees at the consultant and management levels since the company’s top managers have to still approve the attendance to these skills development courses. As this is deemed important for the career development and growth of the employees at all levels, this can be one of the decisive factors for staying or leaving the company.

**Job Satisfaction**

It was found that ICT Risk employees receive good technological resources and equipment. Most employees also get planned on a variety of tasks and projects, but the situation of work overload may arise when work becomes repetitive (same tasks and projects) because of the staff numbers (low in this case) and high client demands. To an extent employees can work flexible hours, pending that all related parties, Company A’s clients and employees, are well informed and approval is granted.

Generally, most employees are satisfied with the nature of their work, but certain employees that perform specialist work still argue that the supply and need of specialised equipment should be strongly motivated because this process is mostly money driven, and not professionally driven. Generally, e-skilled specialists feel that Company A could be more work-driven than money-driven when specialist equipment is required, as this will enable them to complete tasks and projects more efficiently, effectively and be less time consuming.

**Challenging and Interesting Job**

Most interviewed employees feel that their work is highly challenging and interesting, but this situation is also dependent on the level of employment and the area of specialisation. This was particularly the perception at the junior consultant’s level as most of them indicated that on every project they learn ‘*new and interesting things*’. At the senior consultants’ level situation is similar:

> “…our work is really dull at times, but thanks to the vibrant ICT environment of the client we do find some sense of interest. Audit support is becoming second nature now, and this worries me because I feel I need to get more exposure to different tasks.”

The interviewed managers and directors shared the senior consultants’ sentiment.

There were some consultant, specialising in one area of expertise, who felt that their work at times is not challenging enough due to the extent of repetition encountered when carrying out tasks and projects. It was, however, concluded that these retention factor do not bear high significance for Company A.

**Training and Development**

Company A’s Training and Development policies and processes are outlined with immense detail. This, however, does not mean that it is properly managed. Except at a director’s level, it is argued throughout ICT Risk that not enough training initiatives are being promoted and that the communication process with regard to training and development is poor. In one of the interviews, one of the employees stated that

> “we always complete training development work papers to indicate what workshops or courses we should be taking part in. But we never get to go on these courses due to various internal reasons that are out of our control.”

The interviewed employees believe that if you don’t drive the process yourself, you will stagnate within your existing employment level along with your existing skills. However, this factor did not appear as highly significant for the respondents in this study. But analysing this retention factors together with the factor of the personal growth and development, it can be concluded that
these factors combined together can bear much more significance in employees’ decision to leave company or stay.

**Working Conditions**

Company A has a good, safe and relaxed working environment. Directors have their enclosed offices, managers have their enclosed cubicles, and senior consultants have either their own cubicles or share the open plan work desks with other consultants. Although the level of privacy can be deemed as low, this factor appeared as not significant for the retention decision. Since consultants perform most of their work at the client’s offices, any non-crucial changes in the working environment at Company A will have minimal effect on the retention of the e-skilled staff.

**Company’s Reputation**

Company A has an overall good reputation within the industry, among its competitors and clients. They also have a good social responsibility reputation, and serve the community with great interest. To enhance and potentially improve internal ICT operations, the IT Risk Department has implemented a three-year IT Growth Plan, aimed at industry leadership in its area of specialisation. It is deemed that this should greatly boost the IT Risk’s reputation within the industry. As noted during the interview process, all employees agreed that Company A has a ‘good’ reputation amongst competitors and within the industry; therefore, they are ‘proud to be associated with it’.

**Location of Company**

Interviewees indicated that the physical location of Company A’s offices forms part of their employment structure and is regarded as having minimal influence on their motivation to leave or stay at Company A. The location of Company A’s offices serves no potential employment challenges as some of the employees rate the location beneficial in the sense of convenience, ease to access and safety. The company location is the least important for the consultants’ level employees as most of their work is done at the client’s premises.

A minority of employees do feel that it is unsafe and time consuming to travel to work because they live far from the offices and are sometimes forced to use public transport, which is still challenging in many localities of the Cape Town metropolitan area. Some respondents also feel that it is difficult at times to travel from work to client, and vice versa, but they still admitted that the location of the Company A’s offices will not motivate them to end employment with Company A.

**Additional Retention Factors**

As already mentioned, the analysis of the interviews elicited some additional retention factors: Communication, People Management, and Culture.

**Communication**

IT Risk has a good understanding of operational processes and policies at a senior management level. It was noted that senior management along with the Human Resources do not properly and effectively communicate various important guidelines and processes to lower level staff within IT Risk. For example, the promotions process, bonus awarding process and the performance feedback are marked by the respondents as insufficient. This was also evident during the data collection process (interviews and completion of questionnaires) as many respondents at the consulting level either misunderstood or did not understand various processes at all. As this issue
influences their everyday work and the long term progress, the consultants believe that better communication will improve both. Lower levelled staff should also consider that they should make senior management aware that they do not understand certain processes, hence requiring more effective communication. As this was perceived as a crucial retention issue, it should be addressed with due attention by the Human Resources and IT Risk within Company A as this retention factor was ranked as 3rd most important.

**People management**

The interpersonal relationships as well as the levels of respect within IT Risk are of low standards. It can be argued that this is influenced by the employment levels and levels of responsibility, thus causing certain individuals to undermine the employment levels of others as well as undervaluing others. People management at Company A has not set official boundaries or hierarchy. It is the role of management to handle and treat staff as professionally and respectfully as possible. But it is also the role of employees to treat management with the needed respect and professionalism. The People management retention factor was ranked 4th (together with Interpersonal Relationships) as the respondents overwhelmingly stated the importance of managing the staff as professionally and respectfully as possible.

**Culture**

At the time of this study, there was an inadequate state of culture within IT Risk, which arguably stems from the merger between two legacy departments at Company A. This essentially was a merger of a diverse workforce culture and management styles. This brought about a need for the cultural shift in operations and different working styles, having to melt and form a new working experience and culture. And this did not happen or, at least, did not happen as expected. The culture as the retention factor is interrelated with the factors such as Personal Well-being and Interpersonal Relationships, thus can have a negative effect on skilled employees’ performance and their wish to retain in the company. Consequently, the Culture retention factor was ranked as 5th, bearing a very high importance regarding the staff motivation to end employment at Company A or to stay.

**Conclusion**

This study originated against the backdrop that with a shortage of about 70 000 ICT-skilled professionals in South Africa, a serious challenge was presented to every organisation that depends on the expertise of these professionals. Hence, this study was undertaken aimed at exploring the reasons that would impact the decision of ICT-skilled (e-skilled) professionals to remain in the current organisation or not. The main objective was to explore the factors that possibly contribute to the retention of ICT professionals as it was deemed that identifying these factors would lead to better understanding of ways for retaining these e-skilled specialists, thus avoiding the fall in the organisational performance and incurring unnecessary costs for new employments. In that regard, the pertinent literature was reviewed and found 15 major retention factors, which we subsequently tested in an international financial organisation (Company A) operating in Cape Town, South Africa. The empirical study elicited another three factors that were not explicitly mentioned in the reviewed literature.

Ranking the 18 identified retention factors, it has been concluded that the interviewed e-skilled professionals at Company A were the most concerned about:  (i) compensation (remuneration), (ii) promotional opportunities, (iii) empowerment (associated with the decision-making), (iv) interpersonal relationships, (v) personal well-being and (vi) job security. This showed that in the South African workforce the retention factors have not changed in last two decades. In his research in 1993 Greenfield found that the South African workforce predominantly belong to the
Theory X type and, philosophically, to the Rational-Economic beings. In other words, the interviewed e-skilled professionals in Company A were overwhelmingly driven by the need for reward, well-being and security (Greenfield, 1993). In terms of the theories based on needs, this study very much relate to the Alderfer’s ERG Theory (based on Maslow’s Hierarchy of Needs theory), which has established the following hierarchy (Kaliprasad, 2006):

- **Existence needs**: classified as the desire for physiological and material well-being.
- **Relatedness needs**: those needs that satisfy the interpersonal relationships, and
- **Growth needs**: describe those desires for continued personal growth and development.

Analysis of these six factors showed that all of them belong to this hierarchy, hence confirming that e-skilled workforce is largely rationally driven by tangible rewards.

Theoretically, boundaries of this research are modally qualified by the results pertaining only to the researched company (Gregor, 2006) but can be relevant to other companies of the same type and circumstances. The authors believe that the findings of this study might be useful for planning the HR strategies in the researched and similar organisations. The authors also deem that the results of this study can be used as a conceptual base for similar studies. However, it is also important to state that further research on this brad topic should be undertaken. In that regard, it would beneficial to explore, for example, how the emerging concept of “bring your own device” (BYOD) influences retention of skilled ICT personnel or how the immigration regulations impact supply and retention of skilled ICT professionals.

Acknowledging inevitable limited generalisation of the results of this single case study, it is hoped to obtain a feedback from other researchers and practitioners in order to prepare a more informed base for future studies in other empirical environments in South Africa and possible similar countries that struggle with the retention of ICT professionals.

**References**


ICT and Skills Shortage


**Biographies**

**Francois Plaatjies** is a currently a Business Analyst at MasterCard South Africa. He is has completed his Masters degree at the University of the Western Cape, Information Systems department. The focus of his research was the retention of ICT skilled resources in South Africa. Francois' IT/IS experience includes areas such as Information Management, Business Analysis, Data analysis, Information Security, Consulting, Risk Management, and IT auditing. Francois has assisted various academic departments and individuals with their personal and organisational research.

**Dr Zoran Mitrovic** is the Coordinator of the Masters in Information Management Programme at the University of the Western Cape, South Africa. He is the leading author of the South African National e-Skills Plans of Action (NeSPA 2010 and NeSPA 2013). His research and consulting praxis encompasses the development of e-skills in the developmental context, the use of ICT for local socio-economic development, e-government policies and praxis, and the use of ICT for environmentally sustainable development. He has been awarded for his research output.
MobiSOOCs for In-Service Teacher Education:
Design Considerations for Developing Countries

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Abstract

There is a considerable shortage of trained teachers worldwide, which is particularly increasing in countries that allocate low GDP for development of education. With advancement in wireless technologies and high access rate of mobile device used in developing countries, online or distant learning is a potential cost effective alternative to expensive teacher training programs.

Mobile learning enhances learners’ intrinsic motivation by promoting self-regulated learning (SRL). This paper explores the underpinning principles, theories and action framework of a strategic open online course (SOOC) for in-service teacher training. The project was executed through mobile learning (m-learning) pedagogy in Pakistan by a private school system. Results showed that m-learning was cost effective and positively impacted participants’ attention, confidence, satisfaction and relevance of the course material.

Keywords: m-learning, SOOCs, teacher training, self-regulated learning.

Introduction

Many developing countries face an increasing gap for trained teachers. A global total of 10.3 million teachers are expected to be recruited between 2007 and 2015 (UNESCO Institute for Statistics, 2009) however, most countries in sub-Saharan Africa, the Arab States, South and West Asia allocate low GDP for development of quality education and consequently suffer from low resources and finances to invest in continuous in-service teacher training. This increases the ratio of untrained teachers in developing countries. With advancement in information and communication technology (ICT), prior research establishes that different ICT embedded models offers potential solution to build teachers’ professional knowledge alongside acquiring basic e-skills (Zhang & Aikman, 2007).

Online distant learning (ODL) has given a fresh avenue to ICT embedded instruction models. Advancement in mobile phone technology has opened up a huge array of possibilities for distant learning. In recent years, there have been numerous mobile learning (m-learning) projects implemented around the globe to promote self-regulated education (Binsted, Joseph, & Suthers, 2005; Brown, 2001; Cabrere 2002; Chinnery 2006; Kadyte 2003; Kiernan & Aizawa 2004; Levy & Kennedy 2005; Norbrook & Scott 2003; Ogata & Yano 2004; Paredes et al. 2005; Thornton & Houser 2005). A report published by
UNESCO WPS ML (2013) reveals several successful m-learning training initiatives taken in
developing countries in recent decades. Some successful projects include Text2Teach (Philippines, 2003), SMS for Language Learning (Hong Kong, 2006), Literacy Promotion through Mobile Phones (Pakistan, 2009) and BBC Janala (Bangladesh, 2009). Most of these m-learning projects have been experimental in nature as there is little discussion disclosing formal underpinning theories and models contributing to their success. In most projects, the primary method of communication had been short message service (SMS).

In Pakistan, there has been a remarkable success in the development of reliable technological infrastructure for wireless telephony and computing. Advancement of Bluetooth, UMTS (Universal Mobile Telecommunications System), WAP (Wireless Application Protocol), GPRS (General Packet Radio System) and 2G Edge services ensure swift data transfer and broadband connectivity. This development assists users to create and share knowledge using ubiquitous devices. However, with all the infrastructure in place, m-learning is still in its infancy stage in the country (Iqbal & Ahmed, 2010). Rapidly increasing number of mobile users, low prices of smart phones and wireless services which can be used in an educational context (MacCallam & Jeffery, 2009) are the prime promising factors for successful projection of m-learning in Pakistan (Wang & Shih, 2009). However, in the country, there has been little documented research in this area. This project is the first of its nature that has been documented and reported to wider audience.

**MOOCs VS SOOCs**

Massive Open Online Courses (MOOCs), free and easy access to learning material, is a recent development in the field of ODL. Researchers classify MOOCs into three categories on the basis of their design model (Lane, 2012): (1) constructive MOOCs; (2) content-based MOOCs; and (3) task-based MOOCs. Many educationists also propose MOOCs as an alternative to traditional higher education (Kolowich, 2012; Martin, 2012; Pappano, 2012; Yuan & Powell, 2013). However, prior research also realizes that developing specific self-regulatory study skills are essential to benefit from a MOOC with several participants not necessarily sharing homogeneous academic background and development needs. In many cases of training or education delivered through a MOOC, participants report demotivation, frustration, and lack of collaboration and exchange of feedback with peers and instructor. These are repeatedly reported controversial issues in MOOC pedagogy that lead to a considerable rate of early drop outs (Cooper & Sahami, 2013; Daniel, 2012; Downes, 2010; Sharples et al., 2013.). To overcome these challenges, an alternative of MOOC pedagogy is to establish an interactive and exploratory environment for selective participants; a Strategic Open Online Course (SOOC).

SOOCs follow an online pedagogic approach; specific need-based course content, continued motivation by regular feedback and collaboration with course instructor, social alliance with peers and interactive course tools are some distinctive features that make SOOCs more practical than MOOCs.

**Project Prehensile Palms**

In 2010 a web-oriented synchronous collaborative platform was designed to deliver a sixty-four hours long training program for twenty-one primary school teachers belonging to a private school system in Pakistan. These participants were located in different cities of the country and accessed course content with their smart phones. The aim of this model was to develop and test a low-cost mobile learning environment for connecting, collaborating, learning, and reporting to each other. The project design framework is an amalgamation of constructive MOOC pedagogic style with mobile learning (m-learning). On account of limited and selected participants, targeted content, course toolkit, and execution mode; the design model of this project is classified as a mobile-
SOOC (de Waard et al., 2012). This model is an infusion of ubiquitous m-learning with socio-constructive approach of using strategic online courses.

The objective of this paper is to share the design framework of a mobile-SOOC (hereafter mobi-SOOC), the adopted pedagogic approach, and its impact on participants’ motivation and learning outcomes.

**Design Implications of mobiSOOCs for Teacher Training**

In Pakistan, primary schools follow a notably varied curriculum and teaching style, therefore teacher training is unique to the context of each school. This diversity generates potential utility for SOOCs that are designed according to the context of selected participants.

In terms of design, SOOCs best lend themselves to the self-regulated learning (SRL) model that infuses self-centeredness and social interactions (Downes, 2012; Hendricks, 2013). The training model under discussion possesses a design model underpinned by SRL theory and promotes a great sense of autonomy amongst participants constraining them to dual learning skills: self-centeredness and social collaboration (Cazan, 2013). It facilitates different learning styles; participants specify their individual professional goals, select plans that enable them to achieve those goals by choosing from a variety of learning activities. They indulge in social collaboration by reflecting on their own practices and giving constructive feedback to peers. At completion of training program, these investments serve as indicators to differentiate between successful and unsuccessful participants (Tschofen & Mackness, 2012).

Research also supports that SRL, social connectivity, and peer feedback trigger intrinsic motivation. (Deci, Vallerand, Pelletier, & Ryan, 1991). Figure 1 shows over-lapping features of SOOCs and m-learning those generate elements to boost intrinsic motivation.

![Figure 1: Infusion of SOOCs and m-learning resulting into intrinsic motivation boosters.](image-url)
Design Model

Theoretical model
The theoretical project design model was established in the light of Davis’ (1985) Technology Acceptance Model (TAM) to increase participants’ motivation and performance.

![Figure 2: Project Design - Theoretical Model](image)

Technical model
The project technical framework presents a pool of relevant technologies in order to share knowledge and learning material, collaborate, monitor, report, and evaluate. Table 1 gives a holistic view to technologies and perceived actions.

<table>
<thead>
<tr>
<th>Technology Bank</th>
<th>Action</th>
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<tbody>
<tr>
<td>Tutor Participants</td>
<td>Short Message Service (SMS)</td>
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<tr>
<td>Tutor Participants</td>
<td>Main course blog at <a href="http://www.schoology.com">www.schoology.com</a></td>
</tr>
<tr>
<td>Tutor Participants</td>
<td>Tango</td>
</tr>
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<td>Tutor Participants</td>
<td>Google Hangout</td>
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<td>Tutor Participants</td>
<td>Skype</td>
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<td>Tutor Participants</td>
<td>Email</td>
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<tr>
<td>Tutor Participants</td>
<td>Multimedia toolkit in a handheld device</td>
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<tr>
<td>Tutor Participants</td>
<td>Digital collaboration and meetings</td>
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<tr>
<td>Tutor Participants</td>
<td>Email</td>
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Action framework
The implementation framework of the project took inspiration from Keller's ARCS model (1979). Hypothesis of this action framework builds on interactive relationship between learning process
and individual context proposed by Song and Hill (2007). The aim is to keep participants active and motivated by empowering them to schedule, practice, monitor, and evaluate self-learning processes. All assignments and supporting material available at the central course blog can be accessed through participants’ mobile phones whenever they need or want, ensuring positive attention, boosting self-confidence, increasing the degree of relevance and maximizing satisfaction of the participants. Figure 3 synthesizes advantages of moobiSOOC design model and its impact on self-regulated learning, level of self-direction and motivation (ChanLin, 2009; Chyung, 2001; Huang, Diefes-Dux, & Imbrie, 2006).

**Figure 3: Amalgamation of m-learning and Keller's ARCS Model**

**Methodology**

This is an exploratory case study that examines how an online distant learning program for selective participants impacts learning outcomes when the mode of instruction and learning is through a handheld device. The use of a case study method is appropriate because it provides in-depth examination of the impact of mobile learning for a strategically selected group of participants. This approach can provide a holistic account of the phenomenon under investigation (Yin, 2003). This pilot study examines twenty-one primary school teachers. All teachers make use of their personal smart phones; each participant receives a bundle SMS package along with 15GB data contract for four months from a local 3G mobile service provider (UFONE). Participants of the project age from 21 to 50 plus years and possess a range of generic IT capabilities from basic to advanced level. The researcher carried out a basic ICT skill analysis before designing course material. Group communication takes place via main course blog at a freemium service provider. The digital platform provides access to course reading material (pdf. files), audio and video resources. Other free web resources mentioned in Table 1 were used for collaboration in small groups or one-to-one sessions with the researcher.
Data Collection

The researcher collected relevant data over a period of sixteen weeks. Robson (2002) proposed three basic rules in collecting data for a case study: (1) multiple sources of evidence, (2) a case study database, and (3) a chain of evidence.

The researcher collected data from three sources, established a database of the evidence, and used consistent questions for all data collected. The three data sources include the following: (1) Teachers' digital focus group, (2) Personal digital diaries, and (3) Surveys forms focusing on areas affiliated to handling technology, participants' beliefs and motivation.

Qualitative data was collected through fortnightly focus group discussions held via Google Hangout. The discussion focused on the following areas: (a) impact of m-learning on freedom and ease to learn, (b) advantages and disadvantages of strategically selected group members, and (c) m-learning approach VS face-to-face learning method.

The meeting recording serves as minutes for participants to review and verify for accuracy.

Results

All respondents were female (100%). The majority (68%) of the respondents were above the age of 30.5 years, 6% respondents had 5 years or more working experience as a teacher. Only 31% respondents had work experience less than 4 years.

The prime quantitative data represented in Figure 3 was collected by tracking participants’ usage log throughout sixteen weeks, which shows frequent visits throughout the course.

![Figure 3: Data showing participants’ visits to main course blog](image)

Reliability Measurement

Cronbach Alpha is used to measure the reliability of the instrument (see Table 2). The results show that the instrument is highly reliable, the alpha values for LO, PEU, IUE, and PU are 0.793, 0.754, 0.870, and 0.792 respectively. Alpha values for aforementioned are considered reliable as they are higher than 0.70 which is generally considered reliable (Tabachnick & Fidell, 2007).
Table 2: Cronbach’s Alpha

<table>
<thead>
<tr>
<th></th>
<th>Cronbach’s Alpha</th>
<th>No of Items</th>
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<tbody>
<tr>
<td>Learning Objectives (LO)</td>
<td>0.793</td>
<td>4</td>
</tr>
<tr>
<td>Perceived Ease of Use (PEU)</td>
<td>0.754</td>
<td>4</td>
</tr>
<tr>
<td>Intention to Use e-learning (IUE)</td>
<td>0.870</td>
<td>4</td>
</tr>
<tr>
<td>Perceived Usefulness (PU)</td>
<td>0.792</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>0.80225</td>
<td>16</td>
</tr>
</tbody>
</table>

Alpha value > 0.70 shows a reliability.

Pearson Correlations

The results of the Pearson correlations are presented in Table 3. Results show there is:

- no significant relationship between Age (A) and Gender (G);
- a weak positive relationship (a=.198 significant at 0.01) between Pay Scale (S) and Age (A);
- a weak negative relationship (a=-.291 significant at 0.01) between Learning Objective (LO) and Age (A);
- a strong positive relationship (a=.296 significant at 0.01) between Perceived Utility (PU) and Age (A);
- a strong positive relationship (a=.296 significant at 0.01) between Perceived Utility (PU) and Learning Objective (LO);
- a weak negative relationship (a=-.258 significant at 0.01) between Perceived ease of Use (PEU) and years of experience (E);
- a weak positive relationship (a=.172 significant at 0.05) between Perceived ease of Use (PEU) and Learning Objectives (LO);
- a weak positive relationship (a=.222 significant at 0.01) between Intention to Use e-learning (IUE) and Learning Objectives (LO); and
- a moderate positive relationship (a=.465 significant at 0.01) between Intention to Use e-learning (IUE) and Perceived Ease of Use (PEU).

Table 3: Pearson Correlations

<table>
<thead>
<tr>
<th></th>
<th>A</th>
<th>E</th>
<th>LO</th>
<th>PU</th>
<th>PEU</th>
<th>IUE</th>
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<tbody>
<tr>
<td>Age (A)</td>
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<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Experience (E)</td>
<td>.198*</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Learning Objective (LO)</td>
<td>-.291*</td>
<td>-.142</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Perceived Utility (PU)</td>
<td>.296*</td>
<td>-.095</td>
<td>.751*</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Perceived Ease of Use (PEU)</td>
<td>.003</td>
<td>-.258*</td>
<td>.172*</td>
<td>.229*</td>
<td>.465*</td>
<td>1</td>
</tr>
<tr>
<td>Intention to Use E-learning (IUE)</td>
<td>.111</td>
<td>-.066</td>
<td>.222*</td>
<td>.216**</td>
<td>.465**</td>
<td>1</td>
</tr>
</tbody>
</table>

**. Correlation is significant at the 0.01 level (2-tailed).
*. Correlation is significant at the 0.05 level (2-tailed).

Responses from a post-course qualitative survey show that 87% respondents found it a user-directed course. Due to selective participants, homogeneous context, and a variety of feedback gathering platforms, peers’ comments and reviews on classroom practices 95% respondents rated peers’ feedback as the most significant tool through which they gained a range of expertise in
practical learning. 88% respondents reported m-learning promoted personalised learning and because of self-directed targets and deadlines, the ownership was higher compared to previous face-to-face trainer-led training sessions.

Analysis drawn on data collected fortnightly during teachers’ focused group discussions is summarized and an extract of findings is listed in Table 4.

Table 4: Emerging Themes in Participants’ Beliefs and Motivation Levels

<table>
<thead>
<tr>
<th>Emerging Themes of Elevated Motivation</th>
<th>Evidence: Quotes extracted from focused group discussions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Improved ICT skills</td>
<td>“I am tech savvy now, even this word I learnt during reading one of the reading materials uploaded on the blog.” Using the blog for this course has enabled me to create a simple blog for my class, now I can stay connected to my students around the clock” “This phone that I use, so many features I had never tried before. It is really a smart phone, I say out comments and speech detector types in for me while I cook for my family, no hassle for especially sitting down and thinking about my professional development. It is now just like another task on the list for me to do while cooking, cleaning and sometimes ironing clothes, it’s really cool.” “I was expecting to improve my computer skills, instead I improved my mobile skills and now I can teach one whole lesson using only my phone. I never thought before that this thing is a door to open world in a closed classroom.”</td>
</tr>
<tr>
<td>More time to invest in professional-development</td>
<td>“With my mobile in the hand, my training is on the go 24/7 I am really happy that Beaconhouse has taken such an initiative and now I won’t have to stay out for long training hours, I think this is the way it should be for women with families.” “I got so excited about this week’s assignment, I did it and then again I tried another online resource to try with my students. Thanks for a detailed instruction guide and letting me be the in charge of my own learning.” “When I have a problem, all I have to do is post a query on the blog within minutes I get professional advice from course fellows, no more waiting for the next class now.”</td>
</tr>
<tr>
<td>Active engagement</td>
<td>“I don’t have to switch on the computer especially for my work. With this crazy load-shedding and power failure, I think my mobile is the best gadget that keeps me working whenever I wish to work.”</td>
</tr>
</tbody>
</table>

Conclusion

The results of this case study indicate good prospects of introducing SOOC embedded with mobile technology model. It also reveals that distant learning or web-based training programs are most practical cost effective remedy to overcome the growing gap between demand and existing trained teachers in developing countries like Pakistan. This model opens new horizon for teacher training in remote areas of Pakistan with low budget. Such models that use self-regulated learning have potential to boost most learners’ autonomy and intrinsic motivation (Barnard, Lan, To, Paton, & Lai, 2009; Hodges, 2005) leading to lifelong learning skills and provides them a vision towards becoming better practitioners.
Limitations

The current study focuses on a professional learning and development course for teacher education, a customised professional qualification matching the context of only one private school system in Pakistan. Similar studies may be conducted in other related sectors in order to fully capitalize upon the benefits of m-learning in the country.

References


**Biography**

**Mehwish Raza** is a PhD fellow at the center for Teacher Education and School Improvement (IUS) at Alpen-Adria University of Klagenfurt, Austria. She is currently researching on developing Learning Management Systems (LMS) for teachers’ online distant education. She received her Master’s degree in Educational Leadership and Management (MA-ELM) from Pakistan.
Bringing the Future to Life: i-Pads Change Life Outcomes for Over 16 000 Learners

[Extended Abstract]

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Abstract

Around the world, educationalists are struggling to come to terms with the reality that institutional learning needs a radical overhaul. South Africa has been facing an education crisis for decades. Too few and ill-equipped human resources, too few classrooms and parents who are illiterate are some of the many problems that learners experience. The South African government attempted to address this crisis by, inter alia, in 1995, promulgating the South African Qualifications Authority Act (No. 58 of 1995). The emphasis was on outcomes based education and adult learning which included the Recognition of Prior Learning. The purpose was to facilitate ongoing adult learning in the workplace and the SETAs were set up to monitor and assist this process. However South Africa has unique challenges in the learning arena. The legacy of a dysfunctional education system has left many adults illiterate and unable to participate in formal learning. Many companies have branches in all areas of South Africa and this means travel costs and additional training facilitators in order to implement company-wide training. FUEL has successfully utilized online technology to overcome the challenges of geographical spread and adult illiteracy.

Keywords: education, crisis, SAQA, adult learning, online training

Introduction

Many companies in South Africa have embraced the ideals of adult education through ongoing training of their staff. However, these companies also experience challenges. The wide geographical spread of staff throughout South Africa means that consistent training is extremely costly, time-consuming and heavy on human resources. Our history has produced a large number of adults who are illiterate and cannot benefit from traditional training methods. In 2013, FUEL- an online training company in South Africa- was approached by Engen- a large petroleum retailer with nationwide outlets- and asked to develop training that addressed these challenges.

In partnership with Digicape who is a local Apple re-seller, FUEL developed an online training solution which addressed the challenges described above. Online training is a phenomenon which is improving access to education across the globe.
The Solution

Long time partners, *FUEL* and *Digicape* proposed using Apple technology as the delivery platform for a training solution designed by *Engen*. “The tablet format was proposed because it allows for intuitive access to education through a touch screen interface, and is not intimidating for those who are not computer-literate,” says MD of *Digicape*.

Apple iPads were chosen because they offer the best all-round answer to the requirement and the real-life problem of securing expensive training terminals at outlets nationwide – some in remote areas. iPads were tested against the full range of competitor tablets and chosen for their stability, zero defect, lowest failure rates, screen quality, video playback, device security, robustness and manageability. In addition, Apple provides extended warranty contracts for extra insurance.

*FUEL* develops creative, inspiring and interactive learning material targeted at employees with the aim of igniting the joy of learning in employees. *FUEL* builds, hosts & manages online corporate training academies on behalf of major brands ensuring an effective, integrated and managed learning programme.

Because of the unique challenges in the South African training landscape, *FUEL* developed training content which is intuitive and easily accessible to employees. It uses a combination of video and other interactive technology – such as touch-screen devices – to relay content, as well as make use of conventional study material when required. *FUEL’s* training is closely aligned to strategic business goals.

Traditional methods of training can be disruptive, costly and ineffectual in businesses. Impartial technology is utilised by *FUEL* enabling a broader reach to a more diverse audience

Learning Philosophy

The following training principles were met for all users in the deployment of training solutions:

The training developed was:

- **Individualised** – every learner is unique and therefore every solution requires appropriate information and content delivery that suits their competency level and knowledge.
- **Dynamic** – content is designed to be effective and engaging and the interactive learning format facilitates maximum retention.
- **Balanced** – an ideal ratio between live and online solutions dovetail to create easy-to-understand training.
- **Continuous** – Learning is continuous, methodical and systematic and allows learners to progress steadily, at their own level and at their own pace.

With these training principles, *FUEL* has developed a unique system, the Continuous Learning Management System (CLMS), which ensures that all learners are engaged on an ongoing basis with dynamic, cost-effective training.

**Continuous Professional Development (CDP)**

*Company A* recognises Continuous Professional Development in the workplace as the core of the online provision to clients. The approach is designed to support learning opportunities in the Professional Development cycle of all members within an organisation.
Learning solutions are designed around the following six core themes:

- New Hire Induction and Orientation Training
- Leadership and Business Management Training
- Sales Training
- Product Knowledge Training
- Compliance and Regulatory Training
- ICT Software and Systems Training

**Methodology**

**Consult**

*FUEL* consulted extensively with the *Engen* to obtain all the necessary information. Following this was a process of analysis and collation pertaining to their existing systems. Included in this process was an assessment of their current knowledge and the skills gap. Part of this process is obtaining the *Engen’s* long term and short term learning goals. The information obtained was then passed on to the production team.

**Create**

The instructional designers and production team considered all the information that was collated. They designed, mapped and created a unique solution that met the objectives of *Engen* in terms of initiating the training programme which was to upskill their frontline staff, the petrol attendants. They developed a multi-faceted learning programme that and took into account that many of the target learners were illiterate or semi-literate and that there was a range of competence and knowledge.

**Implement**

*FUEL* deployed the training platform and content at 630 outlets across South Africa. The new learning system was launched with minimal demands on the resources of *Engen*. The rollout took 5 months and within this period 60% of the learners had begun their training. Once up and running learners could start acquiring new skills and all training could monitored by head office staff at *Engen*.

The *Managed Service* reduced training administration overheads as services at each retailer are fully managed and facilitated for the duration of the agreement between the parties. The cost of expensive infrastructure and in-house development was therefore reduced.

The platform ensures that clients are able to provide a large amount of content, quickly and effectively, to a wide spread audience in a cost-efficient manner.

**Support**

Learning progress is monitored with monthly service calls, ensuring that the *Engen’s* training is running smoothly and on schedule. Learners progress is mapped which facilitates onward learning. A helpdesk is available to designated users and/or managers 6 days a week.

**Managed Service**

- Fast and effective communications via information and bulletin services;
- Call centre available to all users six days per week;
- Extensive reporting capabilities with customised reporting;
• Comprehensive communications platform for notifications, messaging and alerts;
• Reporting – Administrators and Managers have the ability to access real-time reporting across all users and training departments;
• Reports can be scheduled and delivered to Managers on either a weekly or monthly basis;
• Weekly communication is sent to all users on the system as either a training reinforcement or reminder;
• Bi-Monthly training consultation – every outlet is called to discuss all aspects of the training;
• Content Management;
• Continuous improvement;
• Client Customisation

Utilising this methodology and training approach, FUEL distributed 630 iPads at Engen’s outlets across the country and training began. The training has produced unprecedented results. Engen has more than 16 400 active learners. The learners have completed in excess of 414 623 modules and on average, the system trains 456 learners per day. A programme survey reveals that 99.13% of users find the modules easy to understand. Almost all (99.92%) say the programme helped them do a better job. Random customer satisfaction surveys show that Engen’s outlets having undergone this training score on average 7% higher than those who have not. This is noteworthy as since the inception of Engen’s customer satisfaction survey, no other initiative has ever yielded a greater increase in customer satisfaction.

The training is SAQA accredited and therefore contributes to the learner’s qualifications. It is estimated by Engen that it would have taken them 25 years to train these numbers using traditional methods. Using the iPad is intuitive and thus makes learning accessible to illiterate learners. Customer service has improved as a result of this intervention, but, what is of interest to those concerned with education in South Africa, learners have testified to the fact that their lives have improved as a result of the training.

**Findings**

This project has significance both for the companies initiating training programmes and for the individuals being trained. For the trainees, skills and confidence are gained and it promotes the opportunity for people to progress, who might previously have been excluded from advancing their careers. For businesses, it is important that the training solution is aligned with the government’s Skills Development Strategy, which aims to combat South Africa’s skills shortage by training people already in employment using the various SETA’s.

“This is the first adult education initiative of its kind, and, we believe, the first corporate solution deployed amidst literacy challenges. Its success has surpassed all objectives and expectations. It has set the tone for what’s possible for other employers,” says FUEL’s CEO.

“We could never have imagined that we could complete 145 000 training modules. Using our old training methodology, it would’ve taken us 25 years to get to the same results that we have achieved within the past 12 months,” concludes the Customer Experience Manager at Engen.

On the back of this successful first-stage rollout, Engen is expanding the programme to more of its service stations across Sub Saharan Africa and the Indian Ocean Islands.
Conclusion

The successful result in Engen’s has made a positive change to staff performance, to customer satisfaction and ultimately to the business and has confirmed the effectiveness of FUEL learning philosophy and training methodology.

Biographies

Amanda Reekie is an experienced brand strategist who graduated from WITS with a BA degree and has a Diploma in Marketing Management from the Institute of Marketing Management. She is a marketer who has over 23 years of marketing experience and is now a marketing consultant to FUEL.

Craig Reid, Managing Director. FUEL’s founder, Craig Reid, started the company with the vision of applying technology to develop employees skills to improve his clients’ profitability and enhance corporate efficiencies. He draws on a decade of extensive experience in retail, broadcast technology, video production, professional coaching and training industries.

Driven by a keen insight into triggering human performance through customized technology, Craig pioneered online training in South Africa and more than 10 years down the line has established himself as a specialist in building corporate blended learning academies for a long list of blue chip companies.
YouTube as an Academic Tool for ICT Lecturers

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Abstract

In this paper, the use of YouTube© as an academic tool by lecturers in four Information Systems (IS) departments in South Africa was investigated. Using engaging and entertaining learning tools and techniques inside the classroom has become imperative in order to ensure, amongst others, engagement and motivation for the scholars of today. In this paper, the use of YouTube© by Information Systems lecturers in South Africa is explored for use in the classroom. The findings of our survey indicated that most of the lecturers do use YouTube© but mostly as passive participants. Only one-third of the lecturers indicated that they use online videos in their classes, although two-thirds thought it is a good idea. The research done for this paper opens up a number of new research areas that can be explored.

Keywords: Education, Web 2.0 technologies, YouTube, Student Engagement

Introduction

More and more students at higher education institutions are using information technology and the institutions have to invest money in the latest technologies to meet the needs of their students (Loyd, Dean, & Cooper, 2007). Higher education institutions realise the popularity of Web 2.0 applications, and especially Facebook that has become a pervasive element in our students’ lives (Hewitt & Forte, 2006).

Online social networks have been developing at a high rate over the past three decades (Mazer, Murphy, & Simonds, 2007). Online social networking communities on the internet, such as Facebook, Bebo, Cyworld and MySpace, are an integral part of students’ daily lives and most people’s daily practices (Baker-Eveleth, Stone, & Pendegraft, 2007; Boyd & Ellison, 2008) and online environments create
opportunities to learn. Other examples of online social networking sites are YouTube; Twitter; Flicker; EBay; Yousendit; Cyberchair; Blogspot and Amazon.

YouTube was created as a video-sharing service for everyday users, but has caught the attention of educators. In 2009, YouTube launched YouTube EDU which is a channel produced by colleges and universities. This channel grew in the first year to 30 colleges and universities and over 65,000 videos (Snelson, 2011).

Mazer et al. (2007) raise the following question: ‘What motivates a faculty member to use such a network (social network) as opposed to other forms of mediated communication?’ It is not clear what drives lecturers to make use of new technologies or social networks for academic purposes or as extra mediums for teaching their students. Is it because the lecturer is creative and innovative? Or does the lecturer have the knowledge and skills to incorporate technological mediums as a teaching strategy and others don’t?

Eberhardt (2007) raises the following question: How do social networks affect students’ learning? Thus, lecturers need to understand the possible influence of new technologies such as social networking sites, on student learning, to be able to apply it correctly.

Social networks have growing pedagogical potential, because it offers an opportunity for students to share ideas, knowledge, and individual and group activities Dalsgaard (2008). According to Minocha and Thomas (2007), Blogs, Wiki’s and social network sites such as Facebook, have all been a part of the growing trend towards the creation and sharing of information.

There is a need for an increased awareness of how these online social networks can possibly be applied as an academic tool to supplement traditional teaching. The problem that we explore in this paper is how YouTube can be used as an educational tool. Due to the number of videos that is freely available on YouTube, it is important that educators explore the possible use of this medium.

In this paper we look at the use of YouTube as one such online social network by ICT lecturers in Southern Africa, by first discussing online social networking in education generally. A background of Web 2.0 and YouTube will be given. We also need to look at how we can engage students in learning and then the results of an online survey done will be discussed. We conclude the paper with some findings and recommendations.

Research Questions

The following research questions are raised:

- For which purposes do lecturers make use of YouTube?
- Do lecturers apply YouTube as an academic tool to supplement their teaching strategy?

Before attempting to answer these questions, we first discuss what is explained in the current literature.

Literature Review

Web 2.0

Web 2.0 is a term coined by O’Reilly media in 2003 and refers to the second generation of web-based applications (Duffy, 2007). It characterizes the transition from the read-only Web 1.0 to the participatory, collaborative and distributed Web 2.0 (Greenhow, Robelia, & Hughes, 2009). Even though there are a number of definitions for Web 2.0, none of these exclude one another, because they all refer to the social use of the internet (Grosseck, 2009). Web 2.0 is also known as the
“Read Write Web” (Duffy, 2007) and the Participatory Web (Cain & Fox, 2009). Cain and Fox (2009) state the importance of realizing that Web 2.0 should be treated as an evolution of accustomed and unaccustomed technologies, rather than an entirely new construct.

Web 2.0 is a platform which allows people to share, collaborate and make active contributions to information online (Grosseck, 2009). Unlike the old Web 1.0 whose content was mostly static, Web 2.0 is a dynamic environment where content can change to suit contextual needs (Duffy, 2007). It is a platform where users are valued just as much as the information they are willing to share with others (Greenhow et al., 2009). Web 2.0 also hosts a variety of innovative technologies, which include blogs and wikis (Cain & Fox, 2009). Video casting websites such as YouTube (www.youtube.com), social networking sites like Facebook (www.facebook.com) and micro blogs like Twitter (www.twitter.com) are but a few of the widely used Web 2.0 applications, which are available to anyone (Chui, Miller, & Roberts, 2009). Duffy (2007) highlights a few more key characteristics of Web 2.0 applications which promote usability, which include simple sharing mechanisms for multimedia, the ability for personal profiling and the activation of features for other sites. Chui et al. (2009) state that as the internet continues to evolve, newer technologies will begin to emerge.

**YouTube**

YouTube was founded in February 2005 by Chad Hurley, Steve Chen, and Jawed Karim and can be found online at www.youtube.com (Hansen & Erdley, 2009). It is currently one of the biggest hosts for online video content and the third most popular website after Google and Facebook (Tan & Pearce, 2012). YouTube is a popular form of the Web 2.0 technology (Duffy, 2007) and access to YouTube and creating YouTube accounts is free of charge (Agazio & Buckley, 2009). Playlists and channels are some of the popular features which aid in the reduction of search time and playback efficiency (Tan & Pearce, 2012).

YouTube has grown steadily from 30,000 viewers in April 2005 to 100 million video views per day in July 2006 (Agazio & Buckley, 2009). YouTube was bought by Google in 2006 (Miller, 2010) and in 2007, YouTube had 20 million users and hosted about 60% of all the videos posted on the internet (Hansen & Erdley, 2009). YouTube is a participatory culture, meaning that it does not only host material like sports clips and music videos (Tan & Pearce, 2012), but can also be seen as a repository for user generated video content (Jarrett, 2010). During 2009 YouTube had a total of 258 million users and it was assumed that 65,000 video clips were uploaded on a daily basis, and that every minute, 10 hours’ worth of video were uploaded (Agazio & Buckley, 2009). Currently, YouTube is a website which caters for high volumes of traffic, a platform for broadcasting, a media archive and a social network (Jones & Cuthrell, 2011). As a social network, YouTube allows for sharing, uploading and viewing a wide variety of videos hosted online - these videos can be accessed via blogs, handheld devices and websites (Hansen & Erdley, 2009). In 2012, an average 48 hours of video is uploaded every minute and 3 billion views are generated daily (Wattenhofer, Wattenhofer, & Zhu, 2012).

**YouTube as a learning tool**

Using YouTube in the classroom is an innovative and cost-effective way to bridge the gap between students from the Net Generation and their teachers (Abell, 2011). It has a tool that has been utilized in nursing education (Burke, Snyder, & Rager, 2009; Clifton & Mann, 2011; Hansen & Erdley, 2009). Because most students already use YouTube in their personal lives, seeing this platform in the classroom should not be unfamiliar to them – this also gives those that are unfamiliar with YouTube the opportunity to experience a new technology (Burke et al., 2009). The website offers a wide variety of multimedia content that could be used in teaching (Tan & Pearce, 2012). Tan and Pearce (2012) further mention that this content could be teacher-created
or general content that may be useful in illustrating key ideas and showing students some theoretical aspects of their courses in a practical setting. Additionally, YouTube provides students with the ability to receive information from guest speakers, without actually having the guest speaker present in the classroom (Abell, 2011). Lecturers also have the ability to share the videos with their students allowing them to review what was covered in class at a place and time which suits them – all that is required is an active internet connection (Clifton & Mann, 2011).

**Effects of YouTube on student engagement**

Harris (2011) conducted a study using YouTube in marketing, management and entrepreneurial courses and came to the conclusion that videos inspire learning, engagement and excitement in the classroom. The reason for this is because videos elicit emotions and can have a strong effect on a person’s mind and senses (Berk, 2009). Educational videos also have the ability to heighten the student’s interest in the subject and in turn, may motivate them to learn more (Hansen & Erdley, 2009). This motivation is an example of cognitive engagement (Archambault, Janosz, Fallu, & Pagani, 2009). Displaying videos in the classroom also fuels additional discussion amongst students and aids in (Harris, 2011) enhancing behavioural engagement (Trowler, 2010). These findings coincide with those made by Jones and Cuthrell (2011) and Clifton and Mann (2011), who also convey that videos are powerful discussion catalysts. It is important to illustrate that videos in the classroom are meant to stimulate discussions amongst students, and not become a substitution mechanism for discussion (Clifton & Mann, 2011). “Video is not an end in itself but a means toward achieving learning goals and objectives” (Duffy, 2007). YouTube’s ease of use makes one believe that teachers are no longer necessary, however, teachers do still play a vital role when incorporating YouTube and videos in the classroom, because they are the ones who choose the appropriate videos, initiate and guide discussions to meet a certain aim (Clifton & Mann, 2011). Students feel that the combination of asking questions, offering feedback and the additional commentary of the lecturer somehow “adds” to the quality of a video (Tan & Pearce, 2012). This is an example of emotional engagement in practice (Wolters & Taylor, 2012).

**Limitations and challenges of YouTube in education**

YouTube, just like most technologies also has constraints and disadvantages.

Because YouTube is an environment where every user is free to share what he or she wants, this can create a scenario where student’s access misleading, incorrect or potentially harmful information (Tan & Pearce, 2012). This can occur, since YouTube has no formal quality regulations (Clifton & Mann, 2011). It is important that educators and students research the credibility of any multimedia which they intend to use for educational purposes to avoid the spread of misinformation (Hansen & Erdley, 2009). This will also help students in identifying whether or not information is relevant and unbiased (Clifton & Mann, 2011). Prior to displaying videos in class, faculty must review the entire clip for language and content to ensure its relevance and reliability (Abell, 2011).

Using YouTube in the classroom can also pose as a challenge, because locating appropriate and class-related material in YouTube’s huge video storage can be both difficult and time consuming, especially if the lecturer has no specific video clip in mind (Burke, Snyder & Rager, 2009). Burke, Snyder, and Rager (2009) mention that search efficiency can be improved by searching personalized YouTube pages with similar content or by using appropriate descriptive key words.

A further limitation in using YouTube in education is technology availability (Jones & Cuthrell, 2011). Jones and Cuthrell (2011) state that this can be due to having limited bandwidth, the institution’s proxy and firewall settings or the general lack of hardware in the classroom. Limited bandwidth happens to be a common issue in South Africa (Chetty et al., 2012). It must also be
noted that videos are not always available and can be removed from YouTube for a number of reasons (Abell, 2011).

Further important challenges associated with using YouTube in the classroom are intellectual property and copyright laws (Hansen & Erdley, 2009). It is therefore recommended that faculty include a disclaimer for each video link in the course outline, state that the content of the material is from YouTube and consult with the appropriate officials prior to displaying the video in class (Abell, 2011).

**Student Engagement**

Student engagement has been defined and measured in numerous different ways over the past two decades (Fredericks et al., 2011). Fredericks et al. (2011) state that earlier definitions focus on the behaviour and participation of students. Newer definitions for engagement incorporate the concepts of emotional and cognitive processes (Wolters & Taylor, 2012). Trowler’s (2010) definition for student engagement is “the time and effort students devote to activities that are empirically linked to desired outcomes of college and what institutions do to induce students to participate in these activities”. From this new definition, scientists have begun to view student engagement as a multidimensional construct which reflects on both internal and external factors (Reeve, 2012). The three dimensions associated to student engagement are elaborated below:

- **Behavioural engagement** refers to a student’s ability to abide by behavioural norms, which include attendance, attention and effort (Trowler, 2010).

- **Emotional engagement** focuses on the extent to which a student experiences affective reactions, which can include interest, enjoyment or a sense of comfort towards educators or extracurricular activities (Wolters & Taylor, 2012).

- **Cognitive engagement** covers a student’s competency and willingness to learn and establish goals (Archambault et al., 2009).

Reeve (2012) mentions an additional fourth dimension, agentic engagement, which focuses on the student’s willingness to try and enrich a learning experience, as opposed to passively receiving it as a given.

For the purpose of this paper, when referring to student engagement, the combination of behavioural, emotional and cognitive engagement is meant.

When measuring a student’s engagement for a specific learning activity, their behavioural engagement, emotional engagement and cognitive engagement must all be assessed (Reeve, 2012). The main advantage of having such a multidimensional definition for student engagement is that the concept covers different aspects of human development (Archambault et al., 2009). Archambault et al. (2009) are also of the opinion that a multidimensional definition can aid in prevention and intervention strategies.

**Summary**

Social networking sites should not be avoided or left out of consideration as a supplementary tool in teaching. Lecturers need to find out how best to make use of it, for it to be beneficial to students in an academic environment. YouTube videos can enhance the learning experience of students if used correctly. The fact that student engagement means behavioural, emotional and cognitive engagement in the learning material, makes videos an ideal supplementary tool in the teaching environment.
Lecturers need to understand new technologies to be able to lead the way for students to benefit from the use of it, which support their learning experience and personal development (Cain & Fox, 2009).

Research Methodology

Research Approach
A mainly quantitative approach was selected for this research, as this is attempting to identify and explore individual academic experiences of YouTube. Quantitative methods assume tangible, measurable phenomena.

Research Design
A web-based questionnaire containing closed questions was created and uploaded onto a free online web-based survey platform. Lecturers could access the questionnaire at any time during a two week period with no maximum time limit set. Lecturers from several universities were invited via email to participate in the survey.

Research Sample
The research sample was selected from Information Systems lecturers from the following universities in alphabetical order. Rhodes University, the University of Cape Town, University of Johannesburg, University of Pretoria, and the University of Zululand. An initial sample of lecturers from Information Systems were selected because of easy access and the likelihood that they would be early adopters of such technology.

Unfortunately, only 15 complete and usable results were obtained, making this an initial investigation into the area. The questionnaire contained 8 multiple choice questions, which were designed to explore lecturers use and perceptions of using YouTube. No demographic questions, or questions which could identify a respondent in any way, were asked.

Table 1 lists the questions asked, with possible answers.

Table 1: Questionnaire

<table>
<thead>
<tr>
<th>Question</th>
<th>Possible Answers</th>
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<tbody>
<tr>
<td>1  Do you use YouTube?</td>
<td>Yes; No</td>
</tr>
<tr>
<td>2  If you answered “Yes” in Question 1, please answer the following:</td>
<td>Social; Academic; Social &amp; Academic</td>
</tr>
<tr>
<td>For which purposes do you use YouTube?</td>
<td></td>
</tr>
<tr>
<td>3  Are you actively participating in any channels on YouTube,</td>
<td>Yes; No</td>
</tr>
<tr>
<td>related to your work (teaching) or research interests?</td>
<td></td>
</tr>
<tr>
<td>4  If you answered “Yes” in Question 3, please choose which type of</td>
<td>Research related; Teaching related;</td>
</tr>
<tr>
<td>channels you are actively participating in:</td>
<td>Research &amp; teaching related</td>
</tr>
<tr>
<td>5  Have you ever applied any online video platforms as a tool for</td>
<td>Yes; No</td>
</tr>
<tr>
<td>academic learning as part of your teaching strategy?</td>
<td></td>
</tr>
<tr>
<td>Question</td>
<td>Possible Answers</td>
</tr>
<tr>
<td>-------------------------------------------------------------------------</td>
<td>----------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>6  Do you think that an online video platform, such as YouTube, can be</td>
<td>Yes; No; Not sure</td>
</tr>
<tr>
<td>applied as a tool for academic learning as part of your teaching</td>
<td></td>
</tr>
<tr>
<td>strategy?</td>
<td></td>
</tr>
<tr>
<td>7  Would you consider using YouTube as an academic tool where students,</td>
<td>Yes; No; Undecided</td>
</tr>
<tr>
<td>and students and lecturers can engage in group work or online</td>
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<td>discussions related to the subject content?</td>
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<tr>
<td>8  If you answered “No” in Question 6, please provide a reason why you</td>
<td>Course content not conducive to using videos; There are better tools; Bandwidth</td>
</tr>
<tr>
<td>would not use it:</td>
<td>issues; Security issues; Other</td>
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**Findings**

This section details the questions and the results of the questions mentioned in the above section.

The overwhelming number of respondents (93%) indicated that they use YouTube. Perhaps one can speculate that many of the lecturers who failed to respond, did so as they were not using YouTube. Only one respondent indicated that he/she did not use YouTube.

Of the 14 who confirmed that they use YouTube, 64% use YouTube for both social and academic purposes, while 21% use YouTube purely for social reasons, and 14% indicated that they use YouTube only for academic purposes. As the term ‘social’ use was not defined in the survey, it could have been interpreted in many different ways. For example, some lecturers may have assumed social to mean posting their own links, or spending time searching or viewing videos, while others may have assumed social to imply rating or commenting on videos. There is no way of assessing the ratio between social and academic use of the majority (64%) of the respondents. Some may have had a 90% academic and a 10% social, while others may have had different ratios.

The next question asked if the respondent was participating in any channels on YouTube related to teaching or research interests. The majority (80%) replied in the negative, while only 20% said they were using YouTube. It would be interesting to explore and determine the overall statistics of YouTube users, as to the percentages of active participants verse passive participants. Active participation includes posting videos, commenting and or rating videos, and sharing videos. The fact that only 20% of the lecturers who responded stated that they are active participants is somewhat surprising. One could hypothesise that of these sharing is the most commonly performed activity, and that lecturers generally would be expected to share information/content. This also appears to indicate that lecturers are not taking YouTube seriously as an academic tool, as only 20% of respondents are active participants, one could assume that of those who did not respond to the survey, the rate would have been lower. It would be interesting to explore the effect of age on participation, as the general ICT lecturer in South Africa is over 40. Of the three lecturers who indicated they are active participants, two participate in research and teaching related sites, and the other one in only teaching related sites.

The next question asked if the respondent had ever applied any online video platforms as a tool for academic learning as part of their teaching strategy. Only one third of respondents said yes, surprisingly two thirds said they were not. This question did not mention YouTube, so only 5 Information Systems lecturers are using online videos in their teaching, while 10 said they were not.
One could ask if those lecturers who are not using online videos are out of touch with the modern student, and is it not time to review our teaching strategies?

The following question asked if the respondent thought that an online video platform could be applied as a tool for academic learning as part of their teaching strategy. Interestingly, the figures are the inverse of the previous question, with 10 saying yes, and 5 being unsure. No respondent said no outright. So, all respondents thought it could be used; perhaps they are unsure as to how to use it. They do not appear to have a teaching strategy of using online videos. This appears to be an area where best practices and guidelines could assist. Although no respondent answered an outright no to this question, two respondents indicated that bandwidth or course content prohibited the use of online video. While bandwidth may have been a concern, it should not be a major issue in the universities surveyed. Once again, it would be interesting to explore the second issue, as the authors cannot see any Information Systems course in which online videos could not be beneficial.

The final question asked if the respondent would consider using YouTube to facilitate group work or online discussions. Of the respondents, only 4 (27%) said yes, 1 said no, and 67% were undecided. It would be interesting to explore the reasons behind the answers, in particular the respondent who answered no. Perhaps many were unsure as to how they would use YouTube to facilitate group work or online discussions. This appears to be an area where guidance and encouragement is needed.

**Conclusion and Recommendations**

To be able to answer the research question:

*For which purposes do lecturers make use of YouTube?*

we found that most South African ICT lecturers use YouTube for social and academic purposes. Most of them are passive participants and do not post their own videos or participate in the conversations.

The second research question was:

*Do lecturers apply YouTube as an academic tool to supplement their teaching strategy?*

The analysis of the data suggested that only one third of the ICT lecturers make use of YouTube as a teaching tool, but two thirds of them indicated that they think an online video tool will be useful in the teaching environment. Most of the lecturers was undecided whether they can use YouTube to facilitate group work or online discussions.

What we realised looking at the results from the online survey is that we need to delve deeper into the reasons why ICT lecturers are not taking YouTube seriously as a teaching tool, while most of them felt that it will be a useful tool. We recommend that we conduct focus group discussions and interviews with ICT lecturers to further explore the use of YouTube in our teaching practices.

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YouTube as an Academic Tool for ICT Lecturers


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**Biographies**

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Mobile Women: Investigating the Digital Gender Divide in Cellphone Use in a South African Rural Area

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Abstract

This paper details the findings of a section of research into mobile phone access and use in Keiskammahoek, a small rural community in the Eastern Cape, South Africa. Part of a wider research and development project started in 2012 by a nearby university, this research investigates the gendered aspects of mobile phone use in the community from a critical cultural studies perspective. The data presented here were collected through two gender-disaggregated focus groups and one in-depth follow-up interview. Taking place within a wider context of ICT access and development theory, this research investigates the differences and similarities between men and women’s mobile phone use, and aims to add qualitative texture and detail about this use to existing quantitative access studies. It tentatively concludes that, contrary to earlier research about women’s interactions with earlier ICT in developed countries, rural women are championing mobile phone use in their communities and using them to overcome historical ‘digital divides’ along various demographic intersections. However, socio-economic barriers to access persist and continue to shape mobile phone use in this severely resource-constrained rural area.

Keywords: mobile, internet, ICT, rural, women, gender, social media, intersectionality, South Africa

Introduction

Mobile phones are changing the way we live and work at a rapid speed around the world. By the end of 2014, it is forecast that there will be more than 635 million mobile subscriptions in sub-Saharan Africa (Smith, 2014). In 2013, the UN Human Development Report highlighted the role of telecommunications in economic and social development, fuelling investment, increasing trade and serving millions of previously unbanked people in developing countries (Sousa, 2013, p. 1).

Mobile technology has been heralded as the cheapest and most ubiquitous answer yet to the ‘digital divides’ between those with access to the internet and those without. In their increasing affordability, cellphones present a thus far unparalleled opportunity for people across all strata of society to access the internet and use the rich store of information available there to improve their lives. The present study outlines preliminary
research that was conducted into the use of mobile technology in Keiskammahoek, South Africa. The purpose of the research was to add qualitative depth and specific detail to a baseline study of mobile phone usage in the area. The study takes an intersectional feminist perspective informed by the critical cultural studies tradition to interrogate how young women in the area are using their cellphones, which also informs the methods that were used. It draws upon a growing body of work on new media and inequalities of access and use along demographic variables such as class, race, and gender, explaining the concept of a ‘fourth world’ arranged along various digital divides. The central question is whether ICTs are poised to overcome these systemic inequalities or perpetuate them – even widening their reach.

The wider research project of which this study is part has practical development aims, i.e. exploring the potential of mobile phones, and particularly mobile apps, for the socio-economic upliftment of rural communities in South Africa. As a case study, Keiskammahoek also serves as an entry point into an increasingly important theoretical investigation of digital divides in a world where many people’s first and often only point of contact with the internet has been through a mobile phone. After a brief discussion of the context of the research, we review recent literature investigating the intersection between mobile use and a number of ‘digital divides’, where inequalities along various intersections dictate access to and use of digital technology. First, the conceptual framework informing this approach is outlined with a brief introduction to the critical cultural studies paradigm. Then, the concept of the ‘fourth world’ and the digital divides that characterise it – including gender and other socio-economic factors – is explained. The concept of intersectionality in feminism is discussed with reference to specific case studies relating to the gendered aspects of mobile technology use, with special attention being given to research into rural women’s use of cellphones. Then, the methodology that was employed in this research is outlined. This paper concludes with a discussion of the findings of this specific research, their relation to the project, and their tentative practical implications.

**Context**

This research forms part of a larger project that aims “to foster the development of community media and to explore the potential of ICT for the socio-economic development of [Keiskammahoek]” (Dalvit & Strelitz, 2013. pp. 1-2). Keismammahoek is a relatively small rural area in the former homeland of Ciskei in the Eastern Cape Province of South Africa. The combination of flat and mountainous terrain has implications for mobile phone reception and network coverage is uneven across different villages. Thanks to the involvement of international donors and of different departments at a nearby university, the presence of ICT infrastructure and support in the area is increasing and the local community is relatively well documented. A baseline study in the area in late 2012 (Dalvit & Strelitz, 2013) described the demographics, level of access and basic kinds of uses of mobile phones in the area. The vast majority of Keiskammahoek households in the baseline survey had mobile phones and network coverage – 91% (Dalvit & Strelitz, 2013, p. 7). The high level of mobile penetration shown in this preliminary survey revealed a potential for future development in this field, both in research as well as the creation of custom-made mobile applications that can be put to use by Keiskammahoek residents. The data for this study was collected by fieldworkers with an orally administered, ten-item questionnaire. Data were quantitatively analysed and presented through descriptive statistics in terms of the media landscape in Keiskammahoek, both in terms of access and in terms of types and platforms. This study described the level of access and established the need for further research in areas such as quality and frequency of access to content, and a study of new media use across age, gender, and language. This baseline study informed research projects by two Masters students and another intensive round of surveys administered by fieldworkers in Keiskammahoek – all with the purpose of informing a mobile development project for Keiskammahoek. The scope of this paper, however, is tightly focused on the gendered aspects of mobile phone use and the focus groups and in-depth
interview that were used to interrogate this aspect. While an understanding of this context is important, the findings of the wider research project will be discussed in another companion paper (Dalvit & Kromberg, 2014) and will therefore not be referred to at length in this paper.

**Literature Review: Critical Cultural Studies**

Critical research into the economic, political and, to a lesser extent, social dimensions of digital – and specifically, mobile – technology has flourished in the last couple of years. The present study approaches this literature as well as the research conducted from a critical cultural studies perspective, which is aimed at uncovering the “political stakes” behind everyday cultural practices (Conquergood, 1991, p. 179). By interrogating the power relations that characterise these interactions, critical cultural theory has explicitly political goals of social justice in the form of recognition, redistribution, and representation – often from the “bottom up” (Burgess, 2006, p. 3). Not only is critical cultural studies concerned with “understanding and dignifying ‘ordinary’ people’s lived experiences and cultural practices”, but it also sees these practices – and mass-mediated popular culture in general – as a “site of negotiation and political potential” (Burgess, 2006, p. 2).

In practice, research in the cultural studies tradition has been characterised by linguistic and ethnographic studies of texts and cultural consumption. It introduced the ‘active audience’ paradigm and the importance of interpretive work to socio-economically deterministic critical theory. These developments contribute to a more nuanced understanding of culture and power, and structural determination and human agency. Cultural studies stresses the “complexity and contradictions” of social formations: “any difference, and how it is lived – whether race, gender, class, sexuality, and so forth – is articulated to and by other differences” (Grossberg, 1995, p. 93). What emerges is a complex story of different factors and articulations of structures and identities we call ‘the circuit of culture’.

The development of digital technology in an increasingly information-based society and criss-crossing cultural circuit, where the divisions between media producers and consumers have become blurred, has proven a particularly fruitful avenue for cultural studies critiques (Burgess, 2006). Cultural studies have provided researchers and theorists with a useful and accommodating framework from which to examine the democratising potential of the internet and ICT. Being an intrinsically diverse and contested field of inter-disciplinary study, it is well-suited to discuss the opportunities and challenges that accompany ICT use and development in the 21st century, such as the blurred boundaries between producers and consumers and the increasing importance of ICT for economic and political activity. While the ease and ubiquity of 21st century self-publishing tools poses interesting possibilities for cultural theorists who insist on individual agency and the importance of self-expression (Burgess, 2006), the shift towards an increasingly knowledge and information-based society is of concern to those who acknowledge the importance of structural limitations to human possibility. Critical cultural studies require that both these forces – structural limitations and individual agency – be taken into account in terms of the various intersections that order human experience.

**Digital Divides: The Fourth World**

The ‘Information Age’ is a term that has been used to describe a new paradigm of human organisation in which “synchronized and integrated networks of information, production, and exchange are the new and prominent feature of social organization” (Donner, 2008, p. 29). In this age, economic productivity as well as social organisation depends on information and human activity has been reorganised around various networks (Castells, 1997, p. 7). These changes mean that those who fall outside the information economy due to a lack of skills or resources or other factors are relegated to a theoretical ‘fourth world’, where they do not contribute to or benefit from new systems of organisation (Castells, 2000). But this world is not bound by geographical nation-state
borders: instead it is made up of all those individuals and countries that are excluded from global socio-economic development and progress based on their use of ICT. The ‘divides’ characterising the information society are not only organised around a number of socio-demographic variables, but a whole strata of people based on their level of access and astuteness when it comes to ICT. Castells (2008) employed the phrase to discuss the complex factors that contribute to the asymmetry of ICT access and use and, subsequently, socio-economic development:

Thus, I propose the notion of the emergence of a Fourth World of exclusion, made up not only of most of Africa, and rural Asia, and of Latin American shanties, but also of the South Bronx, La Courneuve, Kamagasaki, or Tower Hamlets of this world. A fourth world that… is predominantly populated by women and children.

(Castells, 2008, p. 8)

While the positive effects of ICT development – especially mobile – have been quite extensively described in such a short period, it is worthwhile returning to the arguments of less optimistic theorists to understand how technological progress could set in motion a process of social exclusion. A number of theorists have written about the power of advantaged groups to “exploit their relatively high proficiency in Internet use to support their relative communicative power in society” (Dutton et al., 2007, p. 33), thus widening the digital divide as their privilege grows exponentially. Previous inequalities and power relations still exist and continue to exist through new informational systems and technologies, which has strengthened and extended them in many ways along the same divisions and intersections. When access to and use of ICT is a central determinant of a community’s participation in the informational system, being left out can have disastrous consequences for that community: “Information technology, and the ability to use it and adapt it, is the critical factor in generating and accessing wealth, power, and privilege in our time” (Castells in Donner, 2008, p. 29). As ICT becomes more important to our social and economic lives, the poor are being left behind. But there is a growing argument that African countries provide unique case studies in light of the explosion of mobile ICT and its innovative use there (Gergen, 2008, p. 297), where developments also provide the opportunity to oppose and restructure existing inequalities. It is true that mobile technology is making ICT cheaper and more easily and widely accessible than ever before (and will predictably continue to do so at an ever-increasing rate), but there are other hurdles to social inclusion than mere access into the growing information society.

The Value of Qualitative Research: From ICT Access to ICT Use

Much of the literature surrounding the ‘digital divide’ critically examines normalisation and stratification theories about whether the digital divide is shrinking or growing in terms of access to ICT, resulting in a seemingly clear-cut division making up the digital divide between “haves and have-nots” (Kreutzer, 2009, p. 4). In terms of mobile technology, research has mostly been done through quantitative studies of access and adoption. While it has been established that more people have access to ICT through mobile technology, this kind of quantitative research into access and coverage fails to take into account the texture and detail of actual ICT usage and the factors that influence inclusion and exclusion in the information age. Moreover, the South African context provides an interesting and underrepresented opportunity for research into the dynamics of its dual economy and the major inequalities characterising it: sectors of the country (both geographically and economically) are developed, and others are still developing (Clark, 2013). Previous studies into ICT access have not left much room for the complex and multifaceted reality of mo-
Mobile phone usage and the individual choices people make when using mobile phones (Kreutzer, 2009, p. 5). Instead, ‘digital divide’ theorisation and research has come down on one or the other side of the debate without a critical investigation of how and why people are using mobile technology and what they are consuming and creating.

Earlier understandings of the digital divide in terms of access have since been expanded to take into account these nuances that affect how people make use of ICT and the role these new technologies play in their lives. While digital divide theorisation provides a solid foundation and critically important context for any work that is to be done on mobile phone usage in South Africa, larger questions around the impact of ICT on human development can only be answered with rigorous empirical research into the social and cultural realities of South Africans in the 21st century. Research into mobile phone usage, especially in developing countries such as South Africa, has revolved around quantitative data about the level of mobile access and the normative, developmental prescriptions of researchers and theorists, failing to address the “cultural and sociological questions that have been discussed in much depth in wealthy nations” (Kreutzer, 2009, p. 5).

Work like that which is being done in Keiskammahoek aims to address this dearth in research into the texture and detail of actual, everyday mobile phone use and link it to various socio-economic and political considerations.

What are the implications of this powerful, ubiquitous, and cheap technology for people and their practices? What will the exponential growth of the mobile industry mean for societies and relations of power along various axes of inequality and oppression? Without such socio-cultural considerations and actual empirical qualitative and quantitative research, theories of normalisation or stratification tend to lead to little more than overly optimistic or overly pessimistic fantasies of the future. Widespread access to ICT cannot be said to have an inherently positive or negative socio-cultural impact as conventional dichotomous notions of the digital divide seem to imply. But the ubiquity, interactivity and increasing affordability of mobile technology does offer a powerful potential tool for economic and social activity and development. In his study of mobile culture on the micro-level, Wasserman paraphrases Ekine on the unique role that Africa might have in determining the future of mobile as follows:

For Ekine (2010, p. xi), the creative ways in which Africans have adopted and adapted the mobile phone, rather than the technology itself, is what makes mobile phones a force for social change.

(Wasserman, 2011, p. 147)

While debates surrounding digital divides tend to focus on whether access to ICT “systematically supports or undermines social relations in a networked society” (Dutton et al., 2007, p. 34), it is important to remember the centrality of people’s individual choices and active agents in society. It is not enough to measure mobile penetration or levels of access and connectivity – although this is an important start, it does not measure the quality and level of actual use and engagement. Qualitative studies of the actual uses individuals are making of their cellphones and the role this technology plays in their lives is crucial in overcoming the impasse between new media theories about the effects of technological development on socio-economic inequalities. Viewing ICT and society as constantly interacting with each other and impacting on one another is a useful way to incorporate the agency engaged netizens have in determining their own use of social media while not discrediting the power of existing power structures in society (Wasserman, 2011, p. 156). People make choices about interactive ICT around them every day: from whether or not to use it to how, why and when they do so. “[D]igital choices made about the use and non-use of the Internet can reconfigure access to people, information, services and technologies” (Dutton et al., 2007, p. 42). The concept of “domestication” refers to the unique, creative, individual and con-
text-specific nature of ICT adoptions and adaptations (Wasserman, 2011, p. 147) as a negotiation amongst and between people and technology.

The impact of this tool depends on actual, specific uses of mobile technology, the study of which has been situated within the appropriate contexts and structures. Using theories which incorporate and contextualise the choices of and opportunities available to mobile users is crucial to predicting what the future of interactive ICT is going to look like, and what it is going to mean for society at large. Kreutz’s quantitative study of the mobile phone use of 441 Grade 11 students at nine schools in low-income areas in Cape Town, South Africa (Kreutzer, 2009) made use of various qualitative methods. The study assessed the “detailed usage [of mobile phones] based on a multitude of activities” and looked for “significant differences for users in this population, based on ownership, gender, language groups, academic or socioeconomic status” (Kreutzer, 2009, p. 4).

In his research, Kreutzer proposes methodological approaches he hopes will enable “a more fact-based discussion about the role of mobile phones in the media landscape” (Kreutzer, 2009, p. 17) and interrogates various aspects such as frequency of use, ratio of mobile phone use to traditional media consumption, ratio of mobile-based to PC-based activities, and a breakdown of specific activities such as news, entertainment, social networking, or research.

Mobile technology provides opportunities for “social networking and communication, media use and production, political activism, as well as education” (Kreutzer, 2009, p. 2). From a political perspective, cellphones give citizens the power to “self-organize popular demonstrations in protest”, the benefit of cheap and transparent election monitoring, and the power to “disseminate information that is suppressed by authoritarian regimes and controlled mass media” (Rheingold, 2008, p. 237). But ICT might very well weaken democracies by hurrying along civic and political decision-making and sacrificing engaged debate and thoughtful deliberation, by putting power into the hands of authorities to manipulate people with “planted provocations and misdirection”, increased surveillance, and the drawbacks of the rapid spread of misinformation (Rheingold, 2008, p. 237). Mobiles are also becoming powerful publishing and broadcasting tools for social activism, political monitoring, transparency, coordination and social mobilisation (Kreutz, 2010, p. 18). ‘Voices of Africa’ is a project where “mobile reporters across Africa use mobile phones to report on events…from an informal area” (Kreutz, 2010, p. 19) using text and video and publish their content in the internet and on traditional media. Another example has been the recent proliferation of citizen bloggers in lots of African countries – from South Africa to Nigeria, Kenya, and Tanzania (Kreutz, 2010, p. 20). Services that make use of text messaging – the most far-reaching mobile communication platform – such as M-Pesa (a mobile banking service) and FrontlineSMS (a system used for election monitoring, where “people collect decentralised information from polling stations”) are crucial because they are cheaper, more accessible and therefore more inclusive (Kreutz, 2010, pp. 20-21).

While mobile technology may have narrowed certain digital divides in internet access by allowing more people to afford ICT (Srivastava, 2008, p. 22), the nature of the technology as a useful economic, social and cultural tool has also been argued to result in a growing divide between those who can afford it and those who cannot. Those who do not have access to digital technology for whichever reason – economic, political, geographic, social, etc. – have limited access to communication and information, which is seen as crucial to development and democratization (Moyo, 2009, p. 125). More people have access to money management facilities thanks to internet and mobile banking, but those who cannot afford the technology do not get to enjoy the benefits. The digital divide is enforced because technology mostly serves those who have access as well as the knowledge and skills to put it to creative use, leaving those who don’t behind. There are arguments for quality access to ICT improving economic equality and enable social mobility and strengthening democracies (Rheingold, 2008, p. 236), but the high cost and limited reach of technology is hampering access to these benefits. Even in a best-case scenario of 100% penetration and availability, where the necessary infrastructure maintenance and upgrades have taken place, “equal exposure is still likely to accentuate existing knowledge
gaps” (Dutton et al., 2007, p. 34) and political and social divides dictating access, such as age, gender, language, class and culture.

Mobile Use in the Developing World

This research in Keiskammahoek presents an example of mobile-centric access, an increasingly prevalent phenomenon that has only been the object of a handful of recent studies into mobile phone use (Gitau et al., 2010, p. 575). For all of the participants in the focus groups and many in the baseline survey, their first (and often, only) point of contact with the internet is via mobile phones instead of through computers or laptops. This presents an interesting and unique configuration that needs to be taken into account to make “needed improvements in theory, policy, and design”, especially because of this phenomenon’s prevalence in poor and resource-constrained communities (Gitau et al., 2010, p. 575). One ethnographic action research into mobile-only internet access in a severely resource-constrained environment saw eight South African women being trained to use their mobile phones and access the internet effectively (Gitau et al., 2010, p. 574). Researchers worked with participants and based the mobile training on their expressed needs and desires, adding qualitative depth and empirical information to this underdeveloped area of mobile research. The study “draws on the concepts of appropriation and domestication to consider adoption not as a single event but rather as a process” (Gitau et al., 2010, p. 575). To help this process along, service providers, technology companies and policymakers need to take into account this complex phenomenon: the study found that “gaps in functionality... [and] information literacy” were harder to overcome for those who did not have PC experience to draw on, and noted other barriers such as affordability and skills (Gitau et al., 2010, p. 591).

Rural areas in developing countries also provide an interesting and divergent case to researchers in mobile technology and social development in terms of privacy and sharing. Sharing behaviour has been described in a few studies in rural areas in India (Steenson & Donner, 2009, p. 233) and South Africa (Dalvit & Strelitz, 2013), amongst others. In Keiskammahoek, 76% of the baseline survey respondents who do not own cellphones have access to one, and sharing allows people access to more advanced mobile technology such as multimedia, network-related activities, and money-related uses (Dalvit & Strelitz, 2013, p. 7-8) Findings such as these “challenge the dominant, default view of mobile phones as personal, individual devices” (Steenson & Donner, 2009, p. 233) and therefore present an important avenue for future research and development.

The Digital Gender Divide

The present study takes a critical perspective on the ‘digital divide’ and acknowledges that differences in access, adoption and use are not only structured in terms of income and class, but a myriad other demographic factors such as sex and gender, age, race, ability, technological know-how to different extents in different contexts. An intersectional feminist approach which focuses on the social category of gender nonetheless needs to take into account other inequalities of power and how they intersect with gender identities. Intersectionality is a crucial tenet of critical cultural studies, and serves as a bridge between the previously contradictory forces of structure and agency. While human experience is still structured by various factors such as economic status, existing inequalities of power and the nature of our institutions, people’s agency to act within these limitations should not be disregarded. Although it was developed in part to overcome the economic determination that crippled most critical positions, cultural studies needs to take into account the complex and shifting relation of economic factors and class with other demographic variables. The term ‘intersectionality’ was coined by American professor Kimberlé Crenshaw in 1989 to describe the way systems of society overlapped in people’s lived experience, although the concept was not so new (Crenshaw, 1989). Although Valentine’s (2007) discussion of intersectionality is undertaken from a feminist geography perspective, the field is inherently inter-disciplinary.
Mobile Women

and her theorisation of the concept is as useful to the field of new media studies as it is to many others. Importantly for feminist theory, “[these] debates led to the centering of white, western, heterosexual, middle-class women and a pluralising of feminism” that took into account people’s lived experiences and the way different facets of their lives constituted these experiences (Valentine, 2007, p. 13). Quantitative studies of these experiences and realities are important, because different ethnographic variables intersect in different and unpredictable ways. Although earlier work in feminism was based on a strong empirical tradition, a recent and general “theoretical turn” within feminism has led to a shortage of empirical inquiry into the relatively recent concept of intersectionality (Valentine, 2007, p. 14).

There are different spheres of life on which mobile technology is thought to impact in different directions: economic stratification or integration, gender equality or inequality, racial inclusion or exclusion, language differences, knowledge gaps and education-related divides are only a few (Dutton et al., 2007, p. 31). Research into the various digital divides affecting the spread and reach of the internet constitute a large part of the work being done around the internet and its impact on society. The present study is concerned with the role of mobile technology in addressing questions of stratification along economic and gender lines. Early studies of internet usage have shown that “men use the internet somewhat more than women, in line with the digital-divide hypothesis” (Dutton et al., 2007, p. 37). But, as we turn to “high-use countries”, gender differences were also shown to diminish (Dutton et al., 2007, p. 37). More recent studies of the gendered aspects of the digital divide, especially in developing countries, have increasingly found that mobile technology has done more to disrupt historical inequalities than ever before.

In the baseline survey conducted at Keiskammahoek, gender differences were most pronounced when it came to money-related activities (Dalvit & Strelitz, 2008, p. 9). “Mothers and sisters generally use a phone to transfer money more frequently than their male counterparts” because women were more likely to receive child support and government grants (Dalvit & Strelitz, 2008, p. 9). This preliminary study concluded with the assertion that there was great scope for growth in new media, particularly among young adopters and women (Dalvit & Strelitz, 2008, p. 9). Research into the gender digital divide takes up a host of issues beyond simple penetration and adoption, including the level, nature, and quality of individuals’ access to ICT and their actual engagement with it (Selwyn, 2004, p. 356) from a gender perspective. Specifically, it also looks at the way the digital divide is related to other historical and social ‘non-digital’ divides. Mostly, this work has been intersectional in theory and takes into account “individual factors such as age, gender, class, geography, ethnicity and disability”, amongst others (Selwyn, 2004, p. 356). In a study of ICT adoption in Dwesa, a marginalised area in the Transkei Region of the Eastern Cape in South Africa, rural women were found to act as the champions of ICT projects in their communities (Mapi et al., 2009, p. 83). Researchers identified three independent variables that impacted on ICT adoption, namely age, education and gender. Contrary to the findings of research into conventional PC internet use and the assumptions that go along with it, Dwesa women “willingly adopted ICTs and became skilled in ICT use” whereas men were slower (Mapi et al., 2009, p. 83).

Hilbert’s analysis of the digital gender divide evident in data sets from 12 Latin American and 13 African countries from 2005 to 2008 found mobile to be a serious contender in traversing the digital divide of PC-only web access. It found that women in fact were more likely to use ICT, although they “continue to be discriminated in many other aspects of social life, including employment, literacy and income... inequalities [which] also throw their shadows on ICT usage” (Hilbert, 2011, p. 487). Hilbert’s research contradicts earlier research on computer use, particularly in the developed world, which found women “underrepresented in their use and ownership of computers” and lagging behind in ICT skills and engagement and thus also the benefits they carry (Cooper, 2006, p. 321). Although mobile has played a role in this development, an important the-
Theoretical distinction has also arisen from it that should change the way we see the digital divide in terms of policy-making, theory, research, and development. Hilbert’s suggestion is that the digital gender divide should be seen “only as a direct reflection of existing gender-related inequalities” and that these economic and social inequalities should be addressed in order “to create policies and projects that truly allow girls and women to become equal members of an information society” (Hilbert, 2011, p. 487). While this understanding of structural understanding of gender relations is useful, Hilbert’s insistence that the “policy actions should make use of the natural communication skills and media capacities of women” (Hilbert, 2011, p. 487) borders dangerously close to an essentialist reduction of gender differences. Nevertheless, his research is a powerful and comprehensive study of women in the developing world’s “proven embrace of the new digital opportunities to overcome longstanding gender inequalities” (Hilbert, 2011, p. 487). He sees this becoming possible through women’s access to and positive attitudes towards ICT, which can enable them to fight existing inequalities. In this way, mobile ICT provides an opportunity for women to overcome “longstanding inequalities [that] prevent [them] from accessing ICT, leading to a vicious circle between digital exclusion, unemployment, low income and lacking education” (Hilbert, 2011, p. 487). Instead of understanding the digital gender divide as a result of innate qualities in men and women, we should theorise it as the product of systemic social, cultural and economic inequalities between them.

Methodology

This paper focuses on the intersections of mobile phone use and gender in Keiskammahoek. In this section, the methodology that was used in the collection of this data is discussed. First, the process that was followed is described, with a discussion of the scope of the study as well as the participant selection process. Then, the choice of methodology is discussed in terms of its position within cultural studies and intersectional feminist approaches. Alongside information from two gender-disaggregated focus groups, one in-depth individual follow-up interview with a member of the female-only focus group was used for data collection. Both the issues of language and gender in relation to mobile use in Keiskammahoek were explored in these focus groups. One set of identical questions was discussed with two groups of four men and four women (See the Appendix). Although these two topics – language and gender – were the focus of two separate research projects, the questions were asked together to each of the two focus groups because of constraints on time, the number of participant numbers and the number of researchers.

Participants for the focus groups were purposively sampled, and the selection of the subject of the in-depth interview followed from these focus groups. Because of the lack of generalisability resulting from the small sample inherent in focus group discussions, we opted for “theoretically motivated sampling” (Morgan, 1997, p. 7). Researchers at the university were in regular contact with a Keiskammahoek community heritage organisation called Ntinga Ntaba ka Ndoda. Members of this organisation took part in the focus groups and helped to select the other participants. Being friends, colleagues, and even family in the case of the female focus group, focus group participants formed quite homogenous groups. Homogeneity in focus group research can be useful: participants feel comfortable speaking to one another, and share enough of a common background and experience for a potentially fruitful conversation to follow (Morgan, 1997, p. 7). The people in this focus group were mostly young, and had taken part due to their active participation in civic activities and social organisations because of the method of selection. For the purposes of identifying gender differences in mobile use – if there were any – these participants were separated into two groups: men and women. The questions that were discussed focused on issues such as phone ownership and sharing, quality and frequency of access and use, language, barriers to use, and specific questions about the communities and groups the participants were part of. Questions about language preferences and use were included in both focus groups, and differences and similarities between the two groups served as a preliminary introduction into the gendered aspects of
mobile access and use. Questions were formulated to generate qualitative data about the access these young men and women had to mobile phones, what kinds of activities they were used for, and what barriers they encountered in terms of high charges, connectivity, and technological know-how.

The focus group and in-depth individual interviewing methods were chosen for their qualitative character. Qualitative studies of the use of ICT represent a relatively recent approach, complementing quantitative research on the impact of the spread of ICT and its consequences for social and economic development and inclusion. Focus group interviews echo the “consciousness-raising (CR) groups” of the women’s liberation movement of the late 1960s and 1970s and adhere to the basic principles of feminist research (Montell, 1999, p. 46), and are also used to achieve the qualitative, subjective depth demanded by cultural studies approaches (Pickering, 2008). In relation to research methodology, these principles include a concern with the relationship between the researcher and the subject which is addressed using “more egalitarian and less objectifying” methods such as focus groups and interviews (Montell, 1999, pp. 49-50). These methods are also used by feminist researchers because they “allow participants to exercise a fair degree of control over their own interactions” (Morgan, 1996, p. 133) and treat them as ‘experts’ on their own lived experiences (Montell, 1999, p. 46). Pini (2006) discussed the value of focus groups as a useful method for feminist social research in rural areas as they “provided space for discussion and reflexivity” (Pini, 2006, p. 339). Although the discussions in the focus groups did not explicitly address gender issues, the openness and emphasis on self-narration and determination of focus group research is nonetheless valuable from a feminist perspective.

The qualitative findings from the present study cannot be taken as representative of the population of Keiskammahoek and is not necessarily applicable to the study of mobile use in other rural areas or with other groups. However, this case study will offer insights into the gendered use of mobile phones in a rural setting, to inform similar interventions. The focus groups were small, with only four men and four women. While most of the participants ranged from 19 to 24 years of age, outliers aged up to 38 were included because of the small number of participants. The limited timeframe of the study meant the focus groups could not be repeated. The two groups comprised of only a few individuals, all coming from a specific and related context of active political and social engagement, and working on the same community heritage project. In the female focus group, three of the women were related to one another. Despite these challenges, the qualitative data collected provides a useful insight into how young women in a rural area access and use mobile phones.

While this research into the gendered aspects of mobile phone access and use in Keiskammahoek forms part of a greater research and practical developmental project, the present study will focus on the findings from two gender-disaggregated focus groups – specifically the female focus group – and the in-depth individual follow-up interview that was conducted with one of the female participants. Conducted with the aim of contributing to a larger research and practical development plan, this research aims to come to greater understanding of specific facets of the diffusion and use of mobile phones in Keiskammahoek (Dalvit & Strelitz, 2013, p. 2) to inform future projects. The original baseline survey discussion of mobile phone penetration, network and use follow, with particular attention to intergenerational and gender differences. This discussion of the subsequent research into the gendered aspects of mobile use in Keiskammahoek addresses only one of the complex range of intersectional features and factors of this use. While the baseline study and other subsequent research addresses such aspects, more research is needed in many different aspects including gender, age, language, socio-economic factors, and race, for example. The present study refer to findings in the original baseline survey and subsequent household surveys only insofar as they provide a wider context for the small, qualitative samples of research conducted in the focus groups and interview.
Findings

The findings of the two gender-disaggregated focus groups as well as the in-depth follow-up interview echo the results of the baseline survey as well as similar qualitative studies of mobile phone usage in rural areas. The following section presents some of the most interesting aspects of these findings in brief before discussing their practical implications. This discussion takes the findings into account in the light of previous work done on mobile technology and the digital gender divide, mobile sharing and mobile-only internet access, and the barriers to access and use that were identified.

All four of the women in the focus group own their own smartphones, and most participants have in many cases owned a feature phone or smartphone for the last three to five years. These phones included a Nokia X2, an MTN Steppa, and two Nokia Asha 201 models. The price for one of these handsets ranges from R499 to R1 000. Most of the participants in the Keiskammahoek focus groups are mobile-first internet users, and many of them only access the internet through their cellphones. All of the participants in both the male and female focus groups have their own cellphone and have had substantial experience with mobile phones, echoing the results of the baseline survey in terms of mobile phone ownership and access (Dalvit & Strelitz, 2013, p. 7): most of the cellphones currently owned by survey participants were acquired in the past two years. All of the participants in both focus groups access various mobile services every day, numerous times a day.

Sharing and Privacy

In some cases, participants reported cellphones being passed down from older siblings and other family members, or being passed on to younger ones when they bought a new cellphone. While the baseline study and subsequent household surveys showed the prevalence of cellphone sharing in Keiskammahoek, the women in the focus group valued the fact that they didn’t have to share their phones with anyone else: “This is only my phone, nobody else uses it,” said one respondent. When prompted to elaborate on how they felt about this, the women unanimously agreed that this was an important and valuable aspect of their mobile phones. Contrary to the emerging literature reviewed in the previous section of this paper, sharing does not seem to be a phenomenon that is on the rise in Keiskammahoek. Rather, evidence points to the fact that sharing happens out of necessity for those who do not have their own mobile phones or have run out of data and airtime on their cellphones.

Uses: Communication, Entertainment, Organisation

The baseline survey categorised and ranked the use of mobile phones for different purposes in the following order: communication, multimedia, network-related, and money-related uses (Dalvit & Strelitz, 2013, p. 8). The women in the focus group focused mainly on the first three activities, communicating in private as well as semi-public and public instant messaging applications, social networking groups and websites, numerous times every day. Although the women reported capturing, downloading, and sharing pictures, music and video using their smartphones on various networks, multimedia formed a larger part of the discussion in the male focus group with men describing the active creation and sharing of content more frequently than the women.

The Keiskammahoek women in the focus group have established social networks that they communicate with on different platforms, including voice calls, SMS/MMS, instant messaging services, social networking applications, and websites. They belong to different private, semi-private and public instant messaging and social networking groups, where they spend most of their time online. One respondent uses Facebook to correspond with members of her church organisation, planning events and gatherings: “We have a Facebook page (sic) for my church group where we
can talk and make plans,” she explains. Facebook groups are also used for political and social mobilisation alongside personal communications. The other women listed political organisations, community projects and social youth groups in which they take part and talk about on these applications. While they were heavy mobile users, they mostly used them for communication and did not prioritise news in their discussion. While the women’s focus group talked more about their instant messaging and social networking activities, the men mentioned emails more often, social networking taking a backseat. Both men and women valued the ability to install apps and access the internet on their cellphones, expressing frustration about their phones’ shortcomings or the high cost of data. Every participant in the women’s focus group uses Facebook, and most use an instant messaging application of some sort. One woman used three instant messaging services: “I need 2Go, WhatsApp and Mxit because I speak to different people on them,” she said. While WhatsApp and Mxit are mostly used to communicate with strangers and friends of friends, Facebook is kept for less personal conversations, and Facebook Messenger does not feature strongly because of high data costs.

An individual follow-up interview with one of the women yielded more specific and detailed information regarding her use of mobile technology to stay in touch with friends, meet new people from around the country, and communicate with members of the political organisations she belonged to. These organisations include the Solidarity Economic Movement and the Democratic Left Front youth groups. She makes use of a chat group on Whatsapp managed by one central person who connects young people he meets from all around the country by adding them to the group, giving them a space to meet each other and talk: “He goes around the country to different events and adds people he meets to the group so that we can talk,” she says. “He changes the name of the group all the time based on a theme.” The respondent described giving and getting relationship and career advice on the chat site: “One girl on there came to us for advice because she thought her boyfriend was cheating. When I have a problem, there are lots of people I have met there that I can talk to in private messages for advice”. But this group is also used for group discussions around news and current events, members often getting into heated debates about national politics. Even though the respondents did not list reading or listening to the news amongst their uses of mobile phones, social networks and instant messaging groups seem to be serving this function in the form of conversation and information-sharing.

**Barriers to Access**

Amongst the men’s and women’s focus groups, the biggest barrier to access was the high cost of mobile data and airtime. This restricted some of the women to instant messaging applications like Mxit and Whatsapp even though they would like to use Facebook more often. For two of the men, these costs made using their mobile phones nearly impossible. One of the other men reported spending R10 a day on data and airtime costs, another R280-R500 per month. The women were not as forthcoming with the precise figures behind their mobile data and airtime expenditure, but unanimously agreed that data costs were too high and restricted their mobile activities to a large extent.

Economic access is not the only barrier to mobile use. As shown by the baseline survey, the vast majority of cellphone users in Keiskammahoek subscribe to MTN, as other networks have very poor network coverage there. These results were reflected in the focus group findings, where everyone was an MTN subscriber. One participant in the women’s focus group said that “…only MTN has good signal” in Keiskammahoek and this is why residents prefer it. Another respondent cited MTN’s slightly lower call rates and special discounts as a factor. Even using MTN, the women still experienced connectivity issues: “Sometimes I have to turn my phone on and off because it isn’t connected anymore,” explained one participant.
Even with smartphones, enough data and strong network coverage, the problem of skills and knowledge in terms of technology presents an epistemological challenge. As one respondent, a 38-year-old woman, says, “My phone is the new one: it has 2Go, WhatsApp, Facebook... but I don’t understand how to download things like Twitter”. The follow-up interview respondent explained that age was also an important factor in mobile phone use: “Some older people only call and SMS, even though they have smartphones. They just don’t know how to use it”.

Conclusions

These findings echo previous research done in Keiskammahoek and similar situations in which women are found to be championing mobile ICT adoption, contrary to earlier research into the gender aspects of internet use and assumptions where women were thought to be lagging behind. The focus groups, which were disaggregated by gender, showed no marked differences in the level of access and frequency of use. Women are being shown over and over again not to be passive spectators of change, but incorporate and appropriate technology in ways that enrich and extend their social, economic and political lives. By focusing on their agency, emerging research can problematise the black-and-white world of the digital divide. Work in this area has tended to focus on the socio-economic structure of society and the cost of properly theorising adoption, domestication, action and resistance.

Albeit small and limited, this empirical sample investigating the gendered aspects of mobile access and use in a rural area reveals a number of ramifications for feminist technology and development praxis. Although this research is qualitative in nature and its scope by no means representative, it forms part of a small but growing body of research into the gendered aspects of mobile phone usage in poor rural areas, and can be understood in the context of ICT development research more generally. When this small sample of empirical research is viewed in the context of the emerging body of work on the democratic promise of the internet and cellphones, smartphone technology seems to problematise the concept of the ‘digital divide’ by virtue of its ubiquity and the ease of internet access it allows. Of course, it is to be expected that this kind of rapid technological shift will challenge and expand existing academic concepts. But emerging research and theorisation seems to suggest something more: mobile phones have quietly revolutionised communications in an unprecedented way which will have many fundamental implications for socio-economic development.

The barriers to this use that have been identified – both for men and women – seem to reflect other existing patterns of inequality. Both groups cited the high cost of data and airtime as one of the greatest barriers to their internet use, indicating that they would make use of the mobile internet more frequently for a wider array of activities if this obstacles were eliminated. Because of their rural location, Keiskammahoek residents also do not have many options when it comes to mobile service providers and are often cut off from connectivity. Mobile phones still have a long way to go if they are to overcome existing socio-economic inequalities. The men and women interviewed in Keiskammahoek are avid mobile technology users but there are still many who will never own a cellphone. This highlights the importance of a nuanced understanding of the complex demographic intersections along which socio-economic life and activity are organised: while mobile technology seems to have overcome some of these inequalities in some cases, others still exist.

What critical cultural studies research and theory can do is investigate the character and texture of the ‘fourth world’ of socio-cultural and technological exclusion that still exists, interrogating inequalities of power and access.
References


The following questions guided the semi-structured focus group interviews with the two gender-disaggregated focus groups:

1. Do you have a cellphone?
2. What kind of cellphone?
3. When did you get it?
4. Do you share your cellphone?
5. What cellphone network do you use?
6. When did you first get a cellphone?
7. What do you do on your cellphone?
8. Which apps/services do you have on your cellphone?
9. Which instant messaging apps/services do you use?
10. Who do you communicate with on your cellphone?
11. Which social network/IM groups do you belong to?
12. What languages do you use on your cellphone?
13. Do you use different languages when talking to different people/on different platforms on your cellphone?
14. Do you feel like airtime is too expensive?
Biographies

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Making Sense of e-Skills at the Dawn of a New Personal Knowledge Management Paradigm

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Abstract

Recent suggestions urge advancing Personal Knowledge Management (PKM) to provide overdue support to knowledge workers for mastering the ever-increasing information abundance, the changing spheres of work, and the needs for self-development and e-collaboration. Based on assumptions of autonomous capacities engaged in creative conversation, these personal devices are supposed to enable the emergence of the distributed processes of collective intelligence and extelligence, which in turn feed them.

Currently, a prototype pursuing this concept and used personally for professional support is about to be converted into a viable ‘next generation’ PKM system. The paper follows up on a series of recent publications which concentrated on the novel concept as well as the numerous renowned Knowledge Management (KM) methodologies and practices integrated in the system design. As an application aiming to aid teamwork, life-long-learning, resourcefulness, and creativity of individuals throughout their academic and professional life and as contributors and beneficiaries of organizational performance, e-literacy and e-skills are both, a requirement for and an outcome of using a PKM device.

To make these interdependencies and the benefits for individuals and society transparent, the paper introduces twelve ‘PKM for Development’ criteria which are closely aligned to Maslow’s Extended Hierarchy of Needs. As enablers of personal development and people empowerment, decentralized autonomous PKM system capacities will give individuals a better chance of advancing their intellectual, social, and emotional capital, but also offer appealing and viable opportunities for their acquaintances in the educational, professional, societal, and developmental context.

Keywords: Personal Knowledge Management (PKM), Organizational Knowledge Management, ICT for Development (ICT4D), PKM for Development (PKM4D), Human Capital, Applied Competences, Capacity Development, Lifelong learning, e-Collaboration, Memes, Knowcations.
Introduction

How can the emerging knowledge societies and the growing creative class of knowledge workers be better served mastering the ever-increasing information abundance, the changing spheres of work, and the needs for self-development and e-collaboration?

Recent suggestions urge advancing Personal Knowledge Management (PKM) to provide overdue support for aiding lifelong learning, resourcefulness, creativity, and team-work throughout an individual’s academic and professional life and as contributors and beneficiaries of organizational and societal performance. Based on assumptions of autonomous capacities engaged in creative conversation, these personal devices are supposed to enable the emergence of the distributed processes of collective intelligence and extelligence, which in turn feed them.

The applied research paper and project report builds upon a series of recent publications and exemplifies such a novel approach in the context of twelve criteria (shown in brackets) for ICT/PKM-related capacity development. Based on a PKM prototype-in-progress about to be converted into a viable application across cloud-based platforms, the solution to be portrayed:

1. Gives preference to grass roots, bottom-up, lightweight, affordable, ‘Personal Devices’ which offer effective low-cost applications (Accessibility Easiness),
2. Endorses ‘Five Vital Provisions’ to promote the notion that knowledge and skills are portable and mobile, and that professionals - moving from one project or responsibility to another – ought to take their PKM version with them (Operable Autonomy),
3. Enables the ‘Creative Authorship’ of own ideas based on one’s background, know-how, and experiences (Expressive Creativity),
4. Facilitates developing one’s ‘Emotional Capital’ as a source of self-understanding, self-reflection, and self-determination (Collaborative Choice),
5. Allows for the nurturing of ‘Social Capital’ as the sum and quality of one’s relationships in collaborative environments (Relational Interactivity),
6. Supports learning and fruitful endeavors either alone or with other users/owners in order to promote creativity, innovation, and the next ‘KM Generation’ (Creative Conversation),
7. Provides the opportunity for employing and furthering one’s ‘Applied Competencies’ to add productively to the ‘World Extelligence’ (Ecological Reciprocity),
8. Assists in maintaining and developing one’s ‘Intellectual Capital’ for career advancement and self-actualization (Personal Mastery),
9. Offers the means for ‘Assisting and Mentoring’ others in the context of the PKM4D criteria and their self-actualization (Encouraging Empowerment),
10. Helps ‘Converting Individual into Organizational Performances’ to foster a productive co-evolutions between Personal and Organizational KM Systems for mutual benefit (Institutional Performance),
11. Eases the ‘Wider Sharing and Faster Diffusion’ of ideas, sources, data, work-in-progress, etc. for the benefit of more rapid iterative improvement (For the Common Good),
12. Makes a crucial difference by ‘Providing the Overdue Support Tools’ and an enabling environment for the creative conversations needed (Technological Progress).

The paper aligns the twelve PKM4D features to Maslow’s Extended Hierarchy of Needs, a structure which will also be employed as a Personal Knowledge Management course outline. The concept portrayed strives to give impetus to a scenario put forward by Levy: “Just as computer science underwent a revolution in the 1980s with the wide-spread use of personal computers, it is possible that Knowledge Management (KM) will in the twenty-first century experience a decentralizing revolution that gives more power and autonomy to individuals and self-organized groups.”
Background

Since Simon (1971) noted that the “wealth of information is creating a poverty of attention and with it a need to allocate that attention efficiently among the overabundance of information sources that might consume it”, over forty years have passed. In the interim, we have experienced profound changes in the way of our working and living and significant organizational, commercial, social and legal innovations triggered by the accelerating progress and the widespread diffusion of Information and Communication Technologies (ICT).

On the one hand, work has undergone a process of fragmentation, which will continue to accelerate (Gratton, 2011). With the growth in specializations and the evolving clusters of domain-specific knowledge, the identification of people has shifted from their company to their occupation and profession, and “the vertical hierarchy and traditional career ladder have been replaced by sideways career moves between companies, [a more horizontal division of labor], and a horizontal labor market” (Florida, 2012). With competitive pressures on organizations continue to grow, so does their need for greater flexibility and skill sets. But, “responsibility for self-development and lifelong learning is now in the hands of the individual, who increasingly controls the development of his/her career and destiny. […] In the world of the modern knowledge worker, it has become necessary for individuals to maintain, develop and market their skills to give them any chance of competitive advantage in the job market in both the short and long term” (Gorman & Pauleen, 2011).

On the other hand, an uneven diffusion of digital technologies and their unequal effects have caused detrimental opportunity divides across societies worldwide. While the ‘digital divide’ describes “the uneven distribution of ICT across society, distinguishing between ‘digerati’ and ‘have-nots’”, the ‘innovation divide’ labels “the gap in technology creation [between technology innovators and non-innovators] and thus in ownership of the related intellectual property” (Drori, 2010). Accordingly, “it is crucial that all countries, large and small, rich and poor, take advantage of science, technology and innovation as fundamental elements for their development strategies, poverty reduction and the construction of a Knowledge Society” (OAS, 2005).

The lessons learnt have led to a collective insight that the most valuable asset in any organization or society is investment in intangible, human and social capital and that the key competitive drivers are knowledge, creativity, and innovation. “The countries that thrive will be those that encourage their people to develop the skills and competencies they need to become better workers, managers, entrepreneurs, and innovators. Today’s policy makers must extend their country’s existing strengths through careful investments in education, institutional quality, and relevant technology. They must create enterprises that are knowledgeable enough to recognize new competitive opportunities - and skillful enough to convert those opportunities into wealth” (WBI, 2008).

“In order to live up to their expected role as a powerful mover and shaker in the necessary transformations of our times, universities have started to reform themselves, often forced by external pressures such as accreditation standards, qualification frameworks, and funding formulas. Business thinking has infiltrated academic management, competition for the best students and faculty members has become a vital priority, and value chains are applied to complement the traditional key performance areas of lecturing, research, outreach, and leadership” (Schmitt & Butchart, 2014).

Higher Education Institutions (HEI) are regarded as the key agents in stimulating long-term economic growth by educating talented, creative, and capable graduates and by producing inventive, pioneering, high-impact research and entrepreneurial spin-offs. However, their efforts to stay relevant are not without criticism, having resulted in higher non-academic staff ratios and cost increases (Economist, 2012) with - according to some commentators - not much to show for as ex-
emplified by questionable impact (Economist, 2012), administrative bloat (Economist, 2013), and non-forthcoming technologies of learning (Laurillard, 2009; OECD 2009; Thille, 2010).

“About 100 years ago, higher education re-structured to meet the needs of the industrial age. It has changed little since, even as the internet has transformed life. Another revolution is needed to modernize universities and prepare graduates for a 21st century working environment. We continue to prepare students as if their career path were linear, definite, specialized and predictable. We are making them experts in obsolescence. We are doing a good job of training them for the 20th century” (Davidson, 2011). Unfortunately, time for institutions to rethink themselves fast enough is in short supply.

A development under way, exploiting the opportunities of cloud-based platforms and applications, is said to become the fourth industrial revolution; it is termed the ‘Industrial Internet’ (Evans & Annunziata, 2012) or ‘Cyber-Physical Systems’ and will facilitate machine learning, machine-to-machine communication, big data analytics, and the Internet of Things by incorporating networked sensors and software into goods and machines resulting in the self-organizational capability of complex value chains. A looming further scenario is the singularity - a point in time when artificial intelligence will outsmart human intelligence. In ‘How to create a Mind’, Kurzweil (2012) foresees the opportunity to amplify the advantageous abilities of the human brain “by migrating from biological to non-biological intelligence. Once a digital neo-cortex learns a skill, it can transfer that know-how in minutes or even seconds”.

As a consequence, the work environment will dramatically change even further. The ‘Future of Employment’ study estimates 47% of the current US employment to be still at risk due to recent technological breakthroughs able to turn previously non-routine tasks into well-defined problems susceptible to computerization; the impact on the 702 analyzed occupations is shown in Table 1 (Frey & Osborne, 2013). In following up on the computerization of European jobs, Bowles’ calculations estimate impacts of new technology onto old areas of employment to range from around 45% of the labor force being affected to well over 60% across the EU-28 countries, with countries on the periphery of the EU most at risk. An impact of this magnitude would necessitate a reallocation of workers towards tasks less susceptible with the likely prioritization of creative and social intelligence. Such a restructuring of the European human capital “is a prospectively painful process and it seems evident that education systems will have to adapt [even further] to meet this challenge” (Bowles, 2014, based on Frey & Osborne, ILO, and EU Labor Force Survey figures).

The new economic focus as well as a smoothly performing society require people everywhere - in their personal lives and as part of the workforce and society - to operate effectively based on the best available knowledge for whatever function they need to perform, including entrepreneurial activities. Accordingly, managing “knowledge and knowledge-related processes throughout society - Personal Knowledge Management (PKM) - has become a central issue” (Wiig, 2012).

The objective of this project report and applied research paper is to present a PKM concept and system that favors the strategic and efficient use of novel personalized ICT devices and focusses on the development of the related knowledge, skills and competences, teaching, self-learning and

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<th>Probability of Computerization in %</th>
<th>&lt; 10</th>
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<tr>
<td>Number of 702 Occupations affected</td>
<td>175</td>
<td>32</td>
<td>34</td>
<td>32</td>
<td>28</td>
<td>32</td>
<td>53</td>
<td>54</td>
<td>103</td>
<td>159</td>
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inventiveness of the workforce and citizens. It further aims to make the strong interdependencies between the PKM approach and its role for e-Literacy and e-Skills transparent.

**Advancing the Personal Knowledge Management Notion**

During the 90s, the author started to develop a concept for Personal Knowledge Management and with it a prototype system which has been continuously expanded and used personally for career support as a management consultant, scholar, professor, and academic manager. Recent advances in development and hosting platforms have now provided a viable opportunity for innovation and its conversion into an application serving a wider audience across technological environments.

Over the last two years, a range of papers and posters (Schmitt, 2012, 2013a-f, 2014a-k) have focused on various aspects of Personal Knowledge Management (PKM), backed up by the further advancement of the PKM System (PKMS) prototype. In acknowledging the trans-disciplinarity of the PKM notion, the peer-reviewed papers received feedback from and addressed a wide scope of conference themes, including Knowledge Management and Knowledge Technologies, Management and Social Sciences, Higher Education and Human Resource Development, Innovation and Creativity Support Systems, Organizational Learning and e-Learning, as well as Future Studies.

Although the concept of the PKM prototype is novel, the need for such a system can be traced back to 1945. Vannevar Bush (then President Truman's Director of Scientific Research) imagined the ‘Memex’, a hypothetical sort of mechanized private file/desk/library-device. It is supposed to act as an enlarged intimate supplement to one’s memory, and enables an individual to store, recall, study, and share the “inherited knowledge of the ages”. It facilitates the addition of personal records, communications, annotations, contributions as well as non-fading trails of one’s individual interest through the maze of materials available - all easily accessible and sharable with the Memexes of acquaintances (Bush, 1945). Unfortunately, Bush’s vision has remained unfulfilled (Davies, 2012; Kahle, 2009; Osis, 2011). The tools available disappoint: “Existing solutions address PKM needs only partially; they concentrate on more specialized as well as wider unrelated tasks and, accordingly, are usually grouped into categories such as Office Suites, Document and Bibliographic Management, Contact and Relationship Management, Group and Collaboration Software, Web Databases, and Organizational Knowledge Management” (Schmitt, 2012).

Academically, Personal Knowledge Management has been placed in a narrow individualistic confinement (Cheong & Tsui, 2011b). In limiting its scope, it has been labelled as sophisticated career and life management with a core focus on personal enquiry (Gorman & Pauleen, 2011) or as a means to improve some skills or capabilities of individuals, negating its importance relating to group member performance, new technologies or business processes (Davenport, 2011).

In ‘People-Focused Knowledge Management’, Wiig (2004) instead argues for shifting the focus of Knowledge Management (KM) toward strengthening the ability of people to act in the best interest of their enterprise and its desired strategies and performance. In this context, PKM needs to be regarded - more appropriately - as a bottom-up approach to KM (Pollard, 2008), as opposed to the more traditional, top-down Organizational KM (OKM) view. As such, PKM also “goes beyond personal information management” (PIM) which focusses predominantly on information processing without the emphasis on creating new knowledge (Cheong & Tsui, 2011a).

In agreeing with these latter positions, a prior paper urges of advancing PKM for ‘Furnishing Knowledge Workers with the Career Tools they so badly need’ (Schmitt, 2013a). Accordingly, the aim of the PKM concept and system-in-progress portrayed is to aid teamwork, lifelong learning, resourcefulness, and creativity of individuals throughout their academic and professional life and as contributors and beneficiaries of organizational and societal performance. It also strives to live up to Bush’s vision alluded to and to a scenario put forward by Levy (2011): ‘Just as computer science underwent a revolution in the 1980s with the wide-spread use of personal comput-
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er, it is possible that KM will in the twenty-first century experience a decentralizing revolution that gives more power and autonomy to individuals and self-organized groups”.

The PKM4D Dozen for Promoting e-Literacy and e-Skills

In order to make the case for Personal Knowledge Management in the e-Skills Conference’s and e-Summit’s context of promoting e-literacy and in developing and supporting e-skills (ICT skills) at all levels of life and work, the arguments put forward are structured according to a newly created framework of twelve PKM for Development (The PKM4D Dozen) criteria.

The scope of the term ‘Development’ – in this regard – is meant to address capacity development holistically and not restricted in space (e.g. development countries) or time (e.g. phase of formal education). After all, with high levels of unemployment and increasing inequality in many countries, the need for improving skills and competencies applies to people at any age and location.

By the same token, the term ‘Knowledge Worker’ - as used in this paper - does not only apply to the narrowly defined socio-economic categories of the developed world. Florida (2012), for example, introduced the concept of the Creative Class as a rising and driving force of economic development and added it to the traditional division of the workforce into an agricultural, working, and service class. Estimated to be one third of the workforce in the United States, their economic function is to create new ideas, new technology, or new creative contents as well as to engage in complex problem solving that involves a great deal of independent judgment and requires high levels of education or human capital.

Yet, Knowledge Worker attitudes and ambitions also do have a role to play in the emerging knowledge societies of developing countries or the countless unemployed graduates seeking to devise a personal career script that can bring fulfillment and meaning in the developed world affected by economic turbulences. Fittingly, Gurteen (2006) places - rather than an individual’s type of work - the virtue of responsibility at the center of his reflections: “Knowledge workers are those people who have taken responsibility for their work lives. They continually strive to understand the world about them and modify their work practices and behaviors to better meet their personal and organizational objectives. No one tells them what to do. They do not take ‘no’ for an answer. They are self-motivated”’. To his mind, they “cannot be coerced, bribed, manipulated or rewarded and no amount of money or fancy technology will ‘incentivize’ them to do a better job. Knowledge workers see the benefits of working differently for themselves. They are not ‘wage slaves’ - they take responsibility for their work and drive improvement”.

The ‘PKM4D Dozen’ criteria put forward incorporate the four ICT for Development (ICT4D) criteria of a framework for designing ICT for human development, named Capable and Convivial Design (CCD). As pointed out by its authors, current ICT for Development efforts “are [unfortunately] primarily framed in the theory and practice of development and empowerment”, signifying “a disproportionate emphasis […] on fulfilling basic needs of users in low-resource environments without adequate attention to user-motivated concerns which would enrich their lives rather than merely provide access and satisfy basic needs.” Based on Sen’s idea of capabilities and Illich’s notion of conviviality, Johri and Pal present their CCD framework to overcome this gap and propose targeting its four primary design characteristics, if ICT4D is to “satisfy its purported goal of making a real difference in the lives of its intended beneficiaries - those that are significantly disadvantaged in terms of resources as well as opportunities” (Johri & Pal, 2012).

Johri’s and Pal’s differentiation between basic resources and enriched opportunities also translates well into the context of the Digital versus the Innovation Divide already alluded to. In the author’s opinion and the PKM context, the four ICT4D criteria also fully apply to knowledge workers anywhere and, hence, have taken up position as PKM4D criteria 1, 3, 5, and 7. Figure 1 provides an overview of the ‘PKM4D Dozen’ criteria which have been placed on and linked to
the levels of an extended version of Maslow’s Hierarchy of Needs (Koltko-Rivera, 2006). Each criteria and its e-Skill relevance will be presented under its individual sub-heading.

![PKM4D Diagram](image)

**Figure 1: The ‘PKM4D Dozen’ Criteria versus the Extended Maslow Hierarchy of Needs.**
(with integration of Koltko-Rivera, 2006; Johri & Pal, 2012)

**PKM4D Criteria 1: Accessibility Easiness (ICT4D-1)**

Hughes (2011) makes the point that human evolution and civilization have not only thrived on big brain memory and communication technology, but also on an insatiable urge to use this technology for the purpose intended. Due to advances in ICTs and their widespread affordability, this urge triggered a recent exponential growth of information. As a result, the familiar problem of information scarcity (few sources/channels, high associated costs) has been substituted with a never before experienced ever-increasing attention-consuming information abundance.

To sustain one’s human existence, certain physiological needs have to be met in order to assure survival. To sustain one’s life as a ‘digerati’ (Drori, 2010) participating in a knowledge society, access to appropriate artefacts linking up to data and information has to be obtained to escape opportunity constraints. ‘Accessibility Easiness’ ensures that the essential “artifacts are universally accessible and that the ability of one person to be able to use the tool should not take away the opportunity from another person” (Johri & Pal, 2012).

The support of a recently introduced modular Master Program at the University of Botswana by a dedicated Google Apps intranet and collaboration platform provides a good example. It facilitates the just-in-time (correct and complete) e-provision of reading material, assignments and solutions to make up for participants’ limited on-campus times and access to lecturers and libraries as well as circumvents the unreliable connectivity of their home and work e-mails. But, moreover, it makes up for the reduced time available (30% compared to program’s full-time mode delivery) for the participants (who are full-time employed across the region) to meet each other face-to-face for discussions, group work, and team building activities.
In the PKM context, ‘Accessibility Easiness’ has to be provided by being able to use effective low-cost devices and Personal Knowledge Management System applications.

PKM4D Criteria 2: Operable Autonomy

With one’s physical needs relatively satisfied, an individual’s safety needs take precedence (Figure 1). In terms of PKM, this equates to the state of our personal knowledge preservation (Figure 2). Here, “we still take copies and store them in diverse arrays of devices or make mental notes only. Over time, copies deteriorate, memories fade and with it the ability to recall the locations and contents of our fragmented personal knowledge inventories and archives. Nevertheless, we are unable to part with our accumulated hard and soft copies which slowly but steadily lapse from potential value towards dead ballast” (Schmitt, 2012).

A remedy – as already briefly alluded to – has been put forward by Bush (1945) and his vision of the Memex. However, “while today we have many powerful applications for locating vast amounts of digital information, we lack effective tools for selecting, structuring, personalizing, and making sense of the digital resources available to us” (Kahle, 2009). The question in need to be asked, why - after nearly seven decades – are we still lacking such an empowering state of personal knowledge formation?

A number of barriers have been identified preventing the establishing of productive PKMS; “they are counterproductive and annoying for wasting time and efforts of individuals, but can be eliminated by initiating sound PKM approaches, shifting paradigms, changing habits, and innovating solutions”. To neutralize these barriers, they have been transformed into a plea for Five Vital Provisions which will strengthen the second PKM4D criteria ‘Operable Autonomy’ (Schmitt, 2014e):
Digital personal and personalized knowledge is always in the possession and at the personal disposal of its owner or eligible co-worker, residing in personal hardware and/or personalized cloud-databases.

Contents are kept in a standardized, consistent, transparent, flexible, and secure format for easy retrieval, expansion, sharing, pooling, re-use and authoring, or migration.

Information and functionalities can continually be used without disruption independent of changing one’s social, educational, professional, or technological environment.

Collaboration capabilities have to be mutually beneficial to facilitate consolidated team and enterprise actions that convert individual into organizational performances.

The PKM system designs and complex operations are based on a concept, functionalities, and interventions which are clearly understood and are painlessly applied in practice.

‘Operable Autonomy’ is supporting individual sovereignty by employing grass-roots, bottom-up, affordable, personal applications. It aims to put an end to the detrimental dependencies experienced as a member of a captured audience and signifies the departure from today’s top-down, heavyweight, prohibitive institutional approaches and centralized developments. As professionals move from one project or responsibility to another, they will want to take their version of a knowledge management system with them supporting the notion that “knowledge and skills of a knowledge worker are portable and mobile. Unlike manual workers, they have numerous options on where, how, and for whom they will put their knowledge to work” (Rosenstein, 2009).

PKM4D Criteria 3: Expressive Creativity (ICT4D-2)

Self-Esteem defines the confidence in one’s own worth or abilities obtained by self-respect, achievement, and recognition (Figure 1). ‘Expressive Creativity’ “focusses on the actual use of the artifact [referred to under ICT4D-1] beyond just access to it for means that give the user joy” and allow for self-expression, for using one’s personal energy creatively, and to personalize one’s environment (Johri & Pal, 2012).

Although the many web-based computing artifacts available today have provided tremendous opportunities in this respect, in KM terms we are also facing an unparalleled accelerating state of information abundance or – as experienced by many – information overload. As a consequence, the accumulating “wealth of information is creating a poverty of attention.” Hence, it “is not enough to know how much it costs to produce and transmit information; we must also know how much it costs, in terms of scarce attention, to receive it. […] In a knowledge-rich world, progress does not lie in the direction of reading information faster, writing it faster, and storing more of it. Progress lies in the direction of extracting and exploiting the patterns of the world – its redundancy – so that far less information needs to be read, written, or stored” (Simon, 1971).

So, the stacks of time and attention we currently loose in our daily grind due to redundant findings, mundane tasks, and rework need to be rather mobilized by appropriate solutions for concentrating - instead - on the creative or innovative targets set (Schmitt, 2013d). PKM concepts and devices, therefore, have to support one’s learning and authorship as well as the development and articulation of one’s own ideas based on one’s knowledge and background.

Henceforth, what the meme-based PKMS concept and prototype portrayed refer to is smaller and more distinct than documents. Memes, originally described by Dawkins (1975) as units of cultural transmission or imitation, are (cognitive) information-structures (Bjarneskans, Gronnevik & Sandberg, 1999) that evolve over time (Figure 3) through a Darwinian process of variation, selection and transmission (Collis, 2003). By digitally capturing, referencing, and visualizing these basic information units and converting them into building blocks of knowledge (in the eyes of the...
beholder), the system allows the user to recall, sequence and combine stored units with his/her own new meme creations for integration in any type of authoring and sharing activity he/she would like to pursue. As a result, the user obtains the means to retain and build upon knowledge acquired in order to sustain personal growth and facilitate productive contributions and collaborations between fellow learners and/or professional acquaintances.

A description of the detailed processes and learning cycles has been provided in an earlier paper (Schmitt, 2014a) and visualized in posters (Schmitt, 2014d, 2014k). Another recent paper adds the corresponding hands-on user perspective and reports how the concept is applied by utilizing the prototype for the paper’s creation (Schmitt, 2014c). A paper focusing on the significance of memes in the PKMS context is forthcoming (Schmitt, 2014j).

**PKM4D Criteria 4: Collaborative Choice**

Self-determination guides the process of controlling one’s own life and career and one’s choice of personal and professional acquaintances (Figure 1). Wiig (2011) reminds institutions that “the overall performance and viability of societies and enterprises result from innumerable small actions by individuals. Small personal 'nano actions' combine with larger departmental actions that combine to create consolidated enterprise actions that result in the performance of the whole organization. [Hence], people must be provided with resources and opportunities to do their best. They need knowledge and understanding as well as motivation and supportive attitudes”.

Florida (2012) stresses that the norms of today’s Creative Class “are different from those of more traditional society. Individuality, self-expression, and openness to difference are favored over the homogeneity, conformity, and ‘fitting in’ that defined the previous age of large-scale industry and organization.” He describes a “new model of economic development that takes shape around the three T’s – technology, talent, and tolerance”, he reports that “the most successful and prosperous
metros excel at all three”, and he finds that “companies were moving to or forming in places that had the skilled people” instead of people moving to jobs. Knowledge workers, who can successfully reconcile the conflicting chances and demands alluded to, have numerous options on where, how, and for whom they will put their portable and mobile knowledge to work, provided they prepare themselves for the opportunities and safeguard against limited alternatives.

Accordingly - like any organization - an individual needs to reflect on his/her past, the current situations, and the future (Figure 4) to adequately prepare for the way ahead - supported by one’s PKMS. The four components of a strategy, Andrews (1987) advocated for enterprises also apply for the individual. Abilities, power, resources (can do), obligations, ethics, social responsibilities (should do) and personal values, motivation, aspirations (want to do) have to be matched against potential opportunities and risks (might do). Choosing the right actions requires also defining the means (ways to do) and ends (agree to do, if not with stakeholders in an organization, then maybe with family and friends). Based on the finalized planning details, the relevant activities have to be timely carried out and the actual performance measures and results need to be monitored in order to take corrective action if required (Schmitt, 2012).

In this endeavor, ‘Emotional Capital’ (EC) represents the set of resources (emotional competencies) that inhere to the person useful for his or her cognitive, personal, social and economic development […] It is also a crucial resource allowing individuals and institutions to be more effective in achieving common objectives [and] seems to be an important factor in explaining why human capital formation, accumulation and exploitation can be different across individuals, jurisdictions and national borders” (Gendron, 2004). As a vital source of self-understanding and self-reflection, Emotional Capital also encompasses the capacity to build emotional resilience and fortitude that will be so important for taking courageous action (Gratton, 2011).

**PKM4D Criteria 5: Relational Interactivity (ICT4D-3)**

The relational third component of the CCD framework “stems from the focus of capability and conviviality on the social aspects of human life and the ability and need for people to form ties with other people. People should be able to develop and maintain associations with others to share ideas and this augments their creativity. This is the backbone to producing and sustaining a society that values individual freedoms” (Johri & Pal, 2012). The notion fits well with Maslow’s level of social needs (Figure 1) which acknowledges the human sense of belonging and acceptance among their social groups, regardless of their population size and the evasion of demoralizing isolation.
Also, “knowledge, as part of all reality, is socially constructed. [...] We learn in context with others. We ‘stand on the shoulders of giants’ when we adopt given wisdom, or rote learning. And, importantly, if our own original thoughts are to be useful to ourselves and others, they must fit within existing structures of meaning, that is, they must ‘make sense’ to our referent group” (Kolb & Collins, 2011). Accordingly, "there is a large school of network researchers who come from a rational self-interest paradigm", where "individuals consider the creation of ties as an investment in the accumulation of social resources or social capital" (Katz, Lazer, Arrow, Contractor, 2004).

Social Capital (SC) has been defined as the “sum of the resources, actual or virtual, that accrue to an individual or group by virtue of possessing a durable network of more or less institutionalized relationships of mutual acquaintance and recognition” (Bourdieu & Wacquant, 1992). Hence, organizations and individuals share a common knowledge management predicament: the scope of a pure contact database or directory is insufficient; one needs insights concerning the resourcefulness of the intellectual capital involved, in terms of the sum of one's ties and the depth of one’s networks.

Gratton (2011) predicts that connections and interactions will become ever more vital. Since finding and keeping regenerative relationships will be a key competence, they also will have to be crafted and nurtured in conscious ways. Lin (2008) described the process of how social capital is expected to produce returns in terms of access or mobilization. "'Accessed Social Capital’ estimates the degree of access to such resources or the extent to which a potential pool of resources capable of generating returns is available in the networks to the actor. It indicates the capacity of capital. An assessment or inventory of resources in the social networks of an actor - accessible or embedded resources - reflects such capacity. [...] ‘Mobilized Social Capital’ reflects the actual use of a particular social tie and its resources in the production or consumption in the marketplace. It represents a selection of one or more specific ties and their resources from the pool for a particular action at hand. For example, using a particular contact with certain resources (e.g., his/her wealth, power or status) in a job search process may indicate a mobilized social capital".

Fittingly, "network researchers have examined a broad range of types of ties. These include communication ties (such as who talks to whom, or who gives information or advice to whom), formal ties (such as who reports to whom), affective ties (such as who likes whom, or who trusts whom), material or work flow ties (such as who gives money or other resources to whom), proximity ties (who is spatially or electronically close to whom), and cognitive ties (such as who knows who knows whom). Networks are typically multiplex, that is, actors share more than one type of tie" (Katz et al., 2004).

The PKMS knowledge bases accommodate the capturing of basic contact information of people, teams, organizations, or communities and allow classifying them according to their research/business/service-related or geographic relevance. Additionally, the PKMS concept and prototype portrayed offers to qualify this Social Capital further by recording their P.R.O.F.I.L.E.S. inter-relationships and roles (Figure 5) as well as their access to relevant personal and shared intellectual capital. The deep and wide coverage of these assets is a key feature and objective of an organizational KMS, but, as pointed out, the relevance equally applies to a Personal KMS. Thus, ‘Relational Interactivity’ - in terms of PKM4D – strengthens the ability to interact and form or maintain relationships with others.
PKM4D Criteria 6: Creative Conversations

Compared to the previous criteria ‘Relational Interactivity’ where a PKMS acts primarily as a recording device of contacts and relationships, the criteria of ‘Creative Conversations’ refers to the actual facilitation of real-time conversations or collaborations between PKMS device users.

The term ‘Creative Conversations’ has been adopted from Levy (2011) who has been cited already with his predicted scenario of a KM revolution putting PKM potentially right at the center stage of the next Knowledge Management System generation. This endeavor has to reach beyond the focus of the first generation of [organizational] Knowledge Management Systems, described by Pasher and Ronen (2011) as the capturing, storing, and reusing of existing knowledge which was viewed as a foremost strategic organizational asset in need to be measured and protected. The next KM generation needs to focus, they argue, on creating new knowledge and innovation, a process which starts with the “reuse or new use of existing knowledge, adding an invention, and then creating a new product or service that exploits this invention.” This process requires creativity and the awareness that old knowledge becomes obsolete.

Levy (2011) bases his scenario on the assumption of decentralized autonomous PKM capacities. Nourished by creative conversations of many individuals' personal knowledge management activities, PKM systems are envisaged to constitute "the elementary process that makes possible the emergence of the distributed processes of collective intelligence, which in turn feed it". Figure 6 attempts to visualize these decentralized creative conversations of autonomous PKM capacities with examples of beneficiaries and opportunities. As a consequence, the PKMS concept offers not only effective low-cost autonomous applications (Accessibility Easiness & Operable Autonomy) and the means for contributing own ideas based on one’s background and preferences (Expressive Creativity & Collaborative Choice), it also facilitates to do it in productive collaborative environments with other users/owners (Relational Interactivity & Creative Conversations).
PKM4D Criteria 7: Ecological Reciprocity (ICT4D-4)

“The root objective of PKM is the desire to make citizens highly knowledgeable. They should function competently and effectively in their daily lives, as part of the workforce and as public citizens. In a society with broad personal competences, decision-making everywhere will maximize personal goals, provide effective public agencies and governance, make commerce and industry competitive, and ensure that personal and family decisions and actions will improve societal functions and Quality of Life” (Wiig, 2011).

Thus, the final ICT4D criteria ‘Ecological Reciprocity’ highlights “the need for people to give back to their environment and not just take resources from it, [a vital pre-requisite for a] participative culture and working in a collective milieu” (Johri & Pal, 2012). The criteria ties in with Maslow’s cognitive and aesthetic needs (Figure 1) and is supposed to translate into opportunities to enrich the environment rather than encountering prospect-poor restraining horizons. But, bearing in mind Gurteen’s definition of a knowledge worker (2006), ‘Ecological Reciprocity’ is not only tied to ‘tit-for-tat’ or work-for-pay-type of interactions, for example:

- “Imagine a world in which every single human being can freely share in the sum of all knowledge” is part of Wikipedia’s commitment and vision statement (2014) in order to create its free online encyclopedia - written entirely by its mostly volunteering users.
- The website Galaxy Zoo has recruited more than 200,000 online volunteers to help astronomers classify galaxy images.
- The Foldit project has recruited 75,000-plus participating volunteers to play an online game challenging them to solve how DNA gives rise to the molecules called proteins.

In ‘Reinventing Discovery’, Nielsen (2011) gives examples of many more citizen science projects. He disagrees with the cynical views “that most people aren’t smart or interested enough to
make a contribution to science” and reasons that “all that’s lacking are tools that help connect them to the scientific community in ways that let them make that contribution”.

For a PKMS concept to assist its user in productively enriching the wider environment and to develop the related skills, it has to support the full cycle of knowledge identification, acquisition, development, distribution, use, preservation, measurement, and goal-setting, referred to as the eight building blocks of knowledge management (Probst, 1998). Boisot’s ‘Agent and the World’ (2004) provides a basic outline for what is involved and has been adjusted to suit the PKM4D context (Figure 7).

**Figure 7: Agent and World Extelligence (based on Boisot, 2004)**

Individual intelligent agents convert external signals into data, information, and thence into knowledge through filtering processes that are guided by preferences, feelings, and the possession of prior knowledge. But, agents have finite brains and intelligence, and the data and information encountered often exceeds what they are able to process or memorize. To overcome these insufficiencies, they make use of external processing and storage devices (Boisot, 2004), referred to as Extelligence. Extelligence forms the external counterpart to the intelligence of the human
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brain/mind and deals in encoded information whereas intelligence deals in understanding; together they are driving each other in a complicit process of accelerating interactive co-evolution. All of the world’s extelligence represents the cumulative archive of the human cultural experience and know-how accessible and augmentable by any individual who knows how (Stewart & Cohen, 1999). Parts of any agents’ extelligence is private and not shared publicly although it might be stored and maintained on devices of external parties. Also, encoded knowledge is “inevitably simplified and selective, for it fails to capture and preserve the tacit skills and judgment of individuals [comprehensively]” (Lam, 2000). Owed to these continuous cycles and learning experiences, an agent also acquires ‘Expertise’ (knowledge that can be demonstrated) and Wisdom.

**Figure 8: Competences, Skills, and Qualification Framework (Schmitt, 2014d; SAQA, 2012)**

To successfully navigate this environment, an agent ought to possess a number of skills and competencies. Figure 7 incorporates the ten applied competence categories of the South African National Qualification Framework (SAQA, 2012) detailed in Figure 8.

Contents related to the ‘Scope of Knowledge’ and ‘Methods and Procedures’ competencies can be stored in the PKMS’s knowledge base to support user’s ‘Problem Solving’ actions. The results and feedbacks of these activities enable learning and the encoding of the knowledge gained, documenting ‘Knowledge Literacy’ and explaining ‘Context and Systems’ in the process. In order to perform information tasks, the competencies ‘Accessing, Processing, and Managing’ and ‘Producing and Communicating’ have to be applied by making use of ‘Networking and Relationships’ which might also be maintained in one’s PKMS as discussed earlier. The handling of these tasks requires ‘Management of Learning’ skills which can be guided by the PKMS assisting and controlling functionalities. Whenever actions are carried out and external extelligence is utilized or contributed, matters of ‘Accountability’ and ‘Ethics and Professional Practice’ have to be adhered to (respective rules, standards, and support can be hosted by the PKMS).

The user’s PKMS interactions and the e-Skills employed involve all of Bloom’s six cognitive process dimensions (remembering, understanding, applying, analyzing, evaluating, and creating). The realization of decentralized autonomous PKM capacities, enabling ‘Creative Conversations’ based on the Five Provisions alluded to, will considerably ease the processes depicted and allow users to interrelate with extelligence more systematically to either develop one’s own competencies further or to add productively to the world’s record in order to enrich the environment.
PKM4D Criteria 8: Personal Mastery

The fragmentation of work and the poverty of attention cause considerable repercussions for knowledge workers. Gratton identifies them as the slipping control over constant interruptions, the loss of time for real concentration, and less learning by observation and reflection. However, it takes time and concentration to become masterful. Gratton (2011) cites psychologist Daniel Lvitin's study of people who have achieved mastery in their role as composers, basketball players, fiction writers, ice skaters ... and master criminals. Lvitin found that, despite their very different areas of skill, they all had one thing in common, “a capacity to concentrate on developing their skill for long periods of time. In fact, he found that 10,000 hours is the common touchstone for how long it takes to achieve mastery” (Gratton, 2011).

In order to steer clear of a lack of proficiencies and "to write a personal career script that can bring fulfillment and meaning", Gratton (2011) recommends attending to and growing one's three sources of capital or resources: Social (SC), Emotional (EC), and Intellectual Capital (IC). The significance of the two former have already been considered in respect to criteria ‘Relational Interactivity’ and ‘Collaborative Choice’. The latter, Intellectual capital, also will become increasingly important for creating valuable jobs and careers, but - to succeed - one has to differentiate oneself from the crowd by building depth and by putting in the time and resources to create a body of knowledge and skills - not only in one single but multiple areas. Greene (2012) describes the intellectual journey involved in this endeavor as follows:

- “You want to learn as many skills as possible, following the direction that circumstances lead you to, but only if they are related to your deepest interests.
- You value the process of self-discovery and making things that are of highest quality.
- You are taking full advantage of the openness of information, all of the knowledge about skills now at your disposal.
- You are not wandering about because you are afraid of commitment, but because you are expanding your skill base and your possibilities.
- When ideas and opportunities inevitably present themselves to you, all of the skills you have accumulated will prove invaluable.
- And, you will be the Master at combining them in ways that are unique and suited to your individuality” and to the needs of your clients and customers.

These needs and desires expressed correspond closely to Maslow’s hierarchical level of Self-Actualization (Figure 1) where “the individual works to actualize the individual’s own potential” (Koltko-Rivera, 2006). Going beyond one’s potential, has been formulated as the Peter Principle which states that - given enough time – “in a hierarchy each employee rises to, and remains at, his[/her] level of incompetence” being unable to carry out his/her duties from that point in time. Work is accomplished only by “those employees who have not yet reached their level of incompetence” and are still awaiting their final promotion (Peter & Hull, 1969).

Unfortunately, people who are unskilled in many social and intellectual domains “suffer a dual burden: Not only do these people reach erroneous conclusions and make unfortunate choices, but their incompetence robs them of the metacognitive ability to realize it” (Kruger & Dunning, 2009). The study results concur with the saying: “Not ignorance, but ignorance of ignorance, is the death of knowledge” attributed to Alfred North Whitehead. Thus, developing our intellectual capital requires more advanced assistance “for identifying and filling knowledge gaps, detecting and correcting flaws, and deciding on suitable means for evaluating and advancing our repositories including the recording of related to-dos, progress, processes, and feedback (Schmitt, 2012).

Fortunately, the domains of ignorance (Armour, 2000; Kerwin, 1993; Schamanek, 2012; UAHSC, 2012) being given prominence by Donald Rumsfeld (2002) provide us with a fitting
classification system to structure the tasks involved and to address the concerns raised and with it some means to overcome them. Figure 9 depicts the extended nine-sector version with the Ignorance Matrix also showing the related learning cycles and associated wastes (Schmitt, 2013f).

In the top corner of Figure 9, the ‘known knowns’ resemble all the explicit or formal knowledge we know or have access to; they form the base we are operating from at any given time. The ‘unknown knowns’ in the bottom corner refer to implicit knowledge (expressible but previously unexpressed or tacit) that is gained experientially and, hence, difficult to articulate, explain, or share. The ‘known unknowns’ in the right corner cover things we know we don’t know; these are personal knowledge gaps in need of being addressed, but also involve knowledge avenues briefly explored but found to be futile. Lastly, the ‘unknown unknowns’ in the left corner represent things we don’t know we don’t know due to a lack of awareness of their existence.

<table>
<thead>
<tr>
<th>Intellectual Capital (IC)</th>
<th>Personal Learning Cycles:</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Extended Ignorance Matrix</strong></td>
<td>A. Unconscious learning by imitation; B. Conscious transformation of tacit into explicit knowledge by articulating and learning through experience and analysis of knowledge gaps; C. Deliberative learning to fill these gaps with ‘second nature’ known unknowns; D. Unconscious learning from tacit knowledge by reflection and learning through experience; E. De-learning of obsolete knowledge through learning (A-B and C-D)</td>
</tr>
<tr>
<td></td>
<td><strong>Seven Wastes:</strong></td>
</tr>
<tr>
<td></td>
<td>1. Distractions due to Maladaptive Occupational Redundancies</td>
</tr>
<tr>
<td></td>
<td>2. Misconceptions due to wrong causal thinking we are right</td>
</tr>
<tr>
<td></td>
<td>3. Misconceptions due to ascribing things to things we know / can access</td>
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<tr>
<td></td>
<td>4. Deflection of Awareness of Known Unknowns</td>
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<tr>
<td></td>
<td>5. Misconceptions due to escape from reality</td>
</tr>
<tr>
<td></td>
<td>6. Missed opportunities due to unconscious unconsciousness</td>
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<td></td>
<td>7. Stagnation due to lack of means to tackle unknown unknowns</td>
</tr>
<tr>
<td></td>
<td><strong>Object Level:</strong></td>
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<tr>
<td></td>
<td>A. Known Knowns</td>
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<tr>
<td></td>
<td>B. Unknown Knowns</td>
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<td>C. Known Unknowns</td>
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<td></td>
<td>D. Unknown Unknowns</td>
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</tbody>
</table>

Figure 9: Intellectual Capital and the Extended Ignorance Matrix (Schmitt, 2014d; based on Kerwin, 1993; Armour, 2000)

The blue lines depict the Learning Cycles and Personal Development Support Needs and address unconscious experiential learning by imitation to create implicit or tacit knowledge (A) and its subsequent potential state of conscious awareness or externalisation (B). Alternatively, they involve deliberate analysis of knowledge gaps (C), conscious learning to fill these gaps (D) with some of the ‘known knowns’ to become ‘second nature’, so that further personal tacit knowledge might be created unconsciously (E).

In addressing gaps, any ‘unknown unknowns’ have to be critically examined, if they can be categorized as ‘Knowables’ (we might not know but others do) or ‘Unknowables’ either temporary (nobody knows yet) or permanently (nobody will ever know). The Cynefin Model shows that the distinctions are of particular relevance when systems or decision making contexts change from simple and complicated to complex and chaotic (Snowden, 2002).

Also, in a dynamic environment, continuous progress and changes take place and newer knowledge adds to or substitutes for older knowledge rendering some of our own ‘knowns’ obsolete. Accordingly, we are in need of keeping our intellectual, social, and emotional capital in a continuous mode of maintenance by monitoring our environment and being guided. This enables us, when needed, to take deliberate corrective action via de-learning (F) and new learning (A-E).

By extending the original domains of ignorance chart from four sectors to a 3x3 matrix personal memory gaps and losses can be distinguished and visualized in the same manner as the personal learning cycles discussed. The approach results in seven potential wastes and resembles the Muda method introduced by Taiichi Ohno (2007) and successfully applied in Lean Operations Practic-
es. The Muda (Japanese term for waste) method provides a common sense heuristic where the elimination or reduction of waste (assuming overall balance is maintained) is improving the overall status of the whole system. In the PKM context, the wastes manifest themselves in form of lost opportunities (time, money, status) or negatively impacted relationships and well-being.

**Waste #1: Distractions due to Massive Obstructive Redundancies**
The intensifying information overload mentioned is fed by high degrees of noise and trivial chatter as well as replicated, fragmented, misconstrued, and incomplete contents exaggerated by missing, broken, or pretentious web links or references. Since Simon (1971) warned about attention poverty, academic publications have increased due to rising student numbers and ‘publish-or-perish’ career policies; repetitions are thriving since many authors appear to be standing on the shoulders of the same giants. Estimates in 2005 predicted that all the knowledge that had been known then will comprise only 1% of all the knowledge available by the year 2030. The advances in search engines are unable to keep pace and, hence, daunting, discouraging, and time-wasting necessities are taking over and weaken individuals’ productivity and advances. Accordingly, our limited time budgets and attention spans are prevented from following any of the more fruitful learning cycles portrayed earlier.

**Waste #2: Defection of Knowledge**
Complementing the sorry consequences of our storage habits (Figure 2 and ‘Operable Autonomy’ criteria), forgetfulness and bad memory cause our non-obsolete knowledge to further deteriorate; but even if we do remember, limited access to or loss and misplacement of records might still prevent a total recall. As a consequence, time and effort has to be re-spent to regain the status of knowledge we once commanded or erroneous conclusions and unfortunate choices transpire.

**Waste #3: Defection of Awareness of known Unknowns**
To some degree we are aware of our areas of ignorance and we have made plans to address them. Alternatively, we might have made a deliberate decision to keep it that way because the expense and time exceed the perceived benefit of investing in that knowledge at a particular point in time (e.g., a source considered not to be useful for a current project). This ‘rational’ state of ignorance can be affected by the same factors discussed in regard to waste #2 with the same consequences.

**Waste #4: Misconceptions due to wrongful Thinking we are right**
Individual erroneous beliefs, assumptions, and judgments as well as outdated know-how can represent a formidable barrier to personal and collective progress and achievement. This type of ignorance does not only stem from inadequate teachings and role models, but also from a lack of constant maintenance of our intellectual, social, and emotional capitals which can push this category up to unacceptable levels. In ‘The Half-Life of Facts, Arbesman (2012) has singled out the underlying causes, naming them preferential attachments, phase transitions (tipping points), decline effects, publication and taxonomic bias, shifting baseline syndromes, factual inertia, and change blindness.

**Waste #5: Misconstructions due to Escape from Reality**
At times, we also might deliberately deny to know, because we are not supposed to (taboos, faith, secrets) or we want to avoid accountability and potential retributions. This waste also includes the psychological suppression of realities to evade distress and pain caused, for example, by traumatic events or experiences.
Making Sense of e-Skills at the Dawn of a New Personal KM Paradigm

**Waste #6: Missed Opportunity due to Unconscious Unconsciousness**

Nonaka’s SECI Loop Model promotes the externalizing of implicit or tacit knowledge in an organizational context for subsequent combination, internalization, and socialization (Nonaka & Takeuchi, 1995). In the light of PKM, being unaware of one’s implicit or tacit knowledge is being ignorant of one’s personal strengths or weaknesses and their potential for improvement and personal progress. This waste or lack of awareness of one’s tacit operational knowledge is closely linked to a similar lack of process knowledge, the ‘unknown ’process’ unknowns’ (Armour, 2000) depicted in the center of the three-dimensional ignorance matrix (Figure 9).

**Waste #7: Inertia due to lacking Means to tackle unknown Unknowns**

In surroundings of ever-increasing ‘unknown unknowns’ and expectations of tackling increasingly complex problem spaces, individuals feel the pressure to engage in wider or unfamiliar contexts of often multi-disciplinary nature in order to widen their horizons. Hence, the seventh waste refers to the lack of process knowledge and suitably efficient means to become aware of relevant ‘unknown unknowns’ and how to tackle them (management of learning at the meta-level). In our context, this need of process knowledge literacy applies to all categories of the ignorance matrix. Lack of it considerably inhibits Personal Learning Cycles and their aim to keep à jour, to intentionally move things from "unknown" to "known" as well as to avoid involuntarily letting things slip from "known" to "unknown" categories.

PKM systems can considerably service ‘Personal Mastery’ by “supporting the personal learning cycles and by avoiding or minimizing the risks of the seven wastes. Users obtain the means to retain and build upon knowledge acquired in order to sustain personal growth and to facilitate productive contributions and collaborations between fellow learners and professional acquaintances” (Schmitt, 2013f). In effect, a PKMS enables self-reflecting monologues of its users over lifelong learning periods, ensures that the extelligence assembled is biographically self-determined and presents itself as a former state of personal knowledge captured. It further secures that users are autonomous in the development of their expertise and how it is used or exchanged with people, communities, or organizations close to them (Schmitt, 2014e).

**PKM4D Criteria 9: Encouraging Empowerment**

The conventional description of Maslow’s Hierarchy of Needs does not reflect his later amendment which “places self-transcendence as a motivational step beyond self-actualization” at the highest level (Figure 1). Self-transcendence seeks to further a cause beyond the self and “may involve service to others or a devotion to an ideal (e.g., truth, art) or a cause (e.g., social justice, environmentalism, pursuit of science, religious faith)” (Koltko-Rivera, 2006). The criteria ‘Encouraging Empowerment’ takes this notion on board by helping others to achieve self-actualization, by aiming to ensure that their potentials are not overlooked, and by acknowledging responsible leadership and integrity in the process.

It is only a century ago, that Frederick W. Taylor, considered to be the father of scientific management, stated: “In our scheme, we do not ask the initiative of our men. We do not want any initiative. All we want of them is to obey the orders we give them, do what we say, and do it quick” (Will, 1997). Since then, the world has experienced an accelerating co-evolution of Physical and Social Technologies (Beinhocker, 2006), including ever-adapting management techniques which have thoroughly transformed Taylor’s hierarchical leadership thinking. Fittingly, Florida (2012) backs this notion in the ‘Rising Creative Class’ by referring to Barley’s observation that bosses – unlike in the old days – do not know their business better than their subordinates any more. Also, not only are the knowledge and skills of a knowledge worker portable and mobile, in our wired world, “information in the form of pure energy can easily fly out of the door and morph into a
thousand variations of the product and service we used to think we owned” (Tarlow & Tarlow, 2002).

What this means to teams, organizations, and communities has been summoned up by Hamel (2012) in ‘What matters now’: “Today, no leader can afford to be indifferent to the challenge of engaging employees in the work of creating the future. Engagement may have been irrelevant in the industrial economy and optional in the knowledge economy, but [in today’s creative economy] it's pretty much the whole game now. [Hence,] if you are a leader at any level in any organization, you are a steward - of careers, capabilities, resources, the environment, and organizational values”.

This call for stewardship applies, in particular, to mentors, coaches, and educators. In line with his prediction of a PKM revolution, Levy (2011) reasons that “one of the most important functions of teaching, from elementary school to the different levels of university, will therefore be to encourage in students the sustainable growth of autonomous capacities in Personal Knowledge Management”.

But, as indicated in the background section, the leadership of educational institutions is seriously questioned and their performance more than ever under scrutiny due to non-delivering e-Learning technology and the declining value-for-money to their students. “Educational services ought to be built on carefully understanding the deeper and long term needs of their clients/students, and then providing them with the means [like PKMS devices in order] to retain and build upon knowledge acquired to sustain personal growth and facilitate productive contributions and collaborations in the advocated knowledge societies” (Schmitt, 2013a). Having internalized and benefitted from the PKMS-supported processes (Figure 10), a graduate can then adopt the technology and methods in a wider context during his/her professional life.

In exploring the hypothetical question: ‘What if an institute of higher learning would not only succeed in accomplishing the learning outcomes set, but also provide its staff, students and graduates with the means whose backing and support would encompass the full life span of an individual’s academic and professional career?”, a recent paper contemplates where a PKM system support approach can make a difference in academic value chains, in the logics and logistics of new knowledge formation, and in paving the way for personal accomplishments (Schmitt & Butchart, 2014).
The PKMS concept and interactions, as shown, foster the development of applied competencies. The knowledge repositories of the current prototype host the memes (text and figures) of all the author’s papers as well as the contents of their referenced citations. They serve as one of the system testing grounds, are used for advancing own authorship projects, and are envisaged as documentation for system support and training.

However, due to the systemic meme-based nature of the PKMS, this support will not only be document-based but available within the system in its meme-based representation with its context-rich linkages, capable of integrating a user’s annotations, comments, lessons learnt and ready of being re-used, re-purposed, and assimilated benefitting the user’s subsequent intended purposes.

A further obvious spin-off of the current system migration process is designing a PKM/OKM course description and training concept in support of the educational needs (Schmitt, 2014b), as highlighted by Levy. The applied research and prior papers have established that central KM philosophies and methodologies can be neatly integrated in the overall PKM concept proposed.

KM Scholars have described the types of knowledge and KM approaches in sometimes complementary, sometimes overlapping or conflicting ways or differentiated, like Skovira (2011), according to Western or Eastern Narratives. Due to the integrative nature of the PKMS concept and technology, the system embodies a common point of departure to introduce a substantial set of KM tools and ideas and their authors in a transparent and coherent manner. Hence, the publishing of a book and the development of corresponding online courses on appropriate platforms - based on the context-rich, multi-dimensional meme structures and trails already in place - are also on the agenda.
PKM4D Criteria 10: Institutional Performance

It has been argued, that the networked academic world paired with the web and cloud-based functionalities of a meme-based PKMS technology is able to provide an enabling environment for the distribution, preservation, development and application of knowledge. Scholars can substantially benefit from its use and its accumulating personalized intellectual, social, and emotional capital and knowledge bases are likely to be a potent trigger for further on-going PKM practices in their commencing careers. As a result, the world’s record is likely to flourish thanks to more empowered individuals with better how-to-employ and how-to-create extelligence skills and due to added knowledge memes and non-fading trails with their superior accessibility.

In regard to the ‘Digital Divide’, a decentralized personal low-cost PKMS device presents a low access barrier, in particular, in those development countries which, in recent years, have experienced a considerable drop in ICT hardware prices and improved Internet and broadband services at reasonable speeds and affordable fees. Foremost, a PKMS addresses the ‘Innovation Divide’.

“Assuming educational institutions would drop their centralized knowledge services software solutions in favor of a decentralized networked PKMS solutions, the students leaving their alma maters would - at last - be able to seamlessly continue to utilize the systems they were familiarized with during their studies in their private and professional life with the potential to benefit from lifelong learning support offered to them as alumni. As a welcome by-product, the PKM skills acquired would contribute significantly toward many of the currently advocated graduate attributes and generic learning outcomes, for example, literacy in ICT; research and information literacy; communication skills; self-directed, lifelong learning; organization and teamwork; entrepreneurship and employability” (Schmitt, 2014h).

Although the PKMS concept aims at departing from the centralized institutional developments and at strengthening individual sovereignty and personal applications, it is not meant to be at the expense of Organizational KM Systems, but rather as the means to foster a fruitful co-evolution. Firstly: Organizations will probably more than welcome recruits armed with the skills and competencies a PKM system imparts on them, because “the quality and extent of knowledge possessed by people - their competence - and structural IC assets available to them determine the realized enterprise performance” (Wiig, 2011).

Secondly: Although the complexity, management and resource requirements (technology & overheads) of an Organizational KMS far exceed those of a Personal KMS, the “shared base of methodologies and concepts, the common resource of the world’s record, and the joint aim to stay competitive and innovate provide strong arguments for OKM and PKM to exploit synergies for mutual benefit” (Schmitt, 2014g). Recent papers have established a common ground of OKM methodologies which have been fully integrated in the PKM concept (table 2); the integration has been visualized in a 3D-Information-Space Model (Boisot, 2004; Schmitt & Butchart, 2014).

Thirdly: Due to these synergies, PKMS and their organizational counterparts ought to partner for pooling and feeding back records and relations. While corporate communication, project, and KM tools currently allow corporate users instant access to resource plans, progress reports, and team members' contributions for works-in-progress, the release of some of the yields into the personal custodies of those contributing tends to be not part and parcel of their functionalities. In an increasingly mobile and cooperative world, KM systems ought to be more 'care & share' oriented for the mutual benefit of its stakeholders (Schmitt, 2012). The aim has to be to collaboratively interlink and collectively harvest prior accumulated knowledge subsets provided the PKMS user also benefits. The integration of ‘individualization’ and ‘institutionalization’ to facilitate consolidated team actions that convert individual into organizational performances and the related role of personal and organizational knowledge assets will be explored further (Schmitt, 2014g, 2014i).
Table 2: Organizational KM Methodologies integrated into the PKM Concept

<table>
<thead>
<tr>
<th>Methodology</th>
<th>Reference to Originators</th>
<th>Reference to Author’s Paper</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eight Building Blocks of Knowledge Management</td>
<td>(Probst, 1998)</td>
<td>(Schmitt, 2012)</td>
</tr>
<tr>
<td>Model of the Sensemaking Loop for Intelligence Analysis</td>
<td>(Pirolli &amp; Card, 2005)</td>
<td>(Schmitt, 2013b)</td>
</tr>
<tr>
<td>JAIST Nanatsudaki Model or Seven Waterfalls Model</td>
<td>(Wierzbicki Nakamori, 2007)</td>
<td>(Schmitt, 2013d)</td>
</tr>
<tr>
<td>Three Sources of Human Capital or Resources</td>
<td>(Gratton, 2012)</td>
<td>(Schmitt, 2013a)</td>
</tr>
<tr>
<td>Academic Value Chain with its 10 Commitments</td>
<td>(Schmitt &amp; Butchart, 2014)</td>
<td>(Schmitt &amp; Butchart, 2014)</td>
</tr>
</tbody>
</table>

* The progress in the development of the PKMS system and functionalities has been visualized in the three-dimensional I-Space Matrix as a series of consecutive figures or posters.

PKM4D Criteria 11: For the Common Good

“Extelligence is not just a matter of ‘keeping a record’. The intelligence of each individual allows them not only to access the cumulative body of extelligence, but to add to it or change it. […] We are what we are because of a remarkable complicity between intelligence and extelligence. Intelligence invents but cannot reliably and accessibly remember what it has invented; extelligence can remember but (on the whole) not invent. Extelligence deals in Information; Intelligence in Understanding” (Stewart & Cohen, 1999).

So, rather than extelligence and “knowledge being shut up in silos and balkanized within small closed communities, one of the ideals of social knowledge management is clearly its decompartmentalization, exchangeability and commensurability. An intelligent collectivity or a collaborative learning network has a truly shared memory only insofar as that memory is constructed and modelled by the creative conversation of its members in a unifying medium” and cannot be optimized via the “well-known silos created by the incompatible formats of the ‘clouds’ controlled by the big companies of the web or the ‘semantic silos’ of ontologies” (Levy, 2011).

A further emerging bottleneck has been pointed out by Nielsen (2012). In ‘Reinventing Discovery’, he reminds us that - since the 17th century - the academic-paper-based citation system has been the basis for the reputation economy in science. It "allows scientists to build on the earlier
work without having to repeat that work. The citation both credits the original discoverer, and provides a link in a chain of evidence”.

To take advantage of today’s online realities, Nielsen (2012) urges removing barriers that prevent potential contributors from engaging in a wider sharing and faster diffusion of their ideas, sources, data, work-in-progress, preprints, and/or code for the benefit of more rapid iterative improvement. “If scientists are to take seriously contributions outside the old paper-based forms, then we should extend the citation system. […] All that's needed for open science to succeed is for the sharing of scientific knowledge in new media to carry the same kind of cachet that papers do today. At that point the reputational reward of sharing knowledge in new ways will exceed the benefits of keeping that knowledge hidden”.

The suggested overhaul would not only benefit the contributors of the many citizen science projects Nielsen refers to, but also would provide further relief from the detrimental effects caused by the opportunity divides as discussed in the subsection ‘Ecological Reciprocity’.

Bush (1945) based his bold vision on the observations of a steadily “growing mountain of research” and an “increased evidence that we are being bogged down” as specialization extends further in the name of progress. He regarded our methods of transmitting and reviewing the results of research “to be generations old” and “totally inadequate for their purpose”. He also believed that “the world has arrived [back then in 1945!] at an age of cheap complex devices of great reliability” and, hence, that this technology would be able to provide the means to make intellectual excursions more enjoyable by “reacquiring the privilege of forgetting the manifold things [one] does not need to have immediately at hand, with some assurance that [one] can find them again if they prove important”. His remarkable insight is proving more relevant than ever before.

Bush foresaw the appearance of new forms of encyclopedias with an extensive mesh of associative multi-disciplinary trails already built-in as well as a new profession of trail blazers who find delight in the task of establishing useful trails through the enormous mass of the common record. The PKMS concept portrayed aims to provide users finally with the functionalities of the Memex envisioned seven decades ago. To paraphrase Bush: “As an added benefit of the trails captured, content provided by the PKMSs’ creative conversations becomes not only their additions to the world's record and extelligence, but includes for the acquaintances or community the entire scaffolding by which the content has been erected” (original: “As an added benefit of the trails captured, the inheritance from the master becomes not only his additions to the world's record, but includes for his disciples the entire scaffolding by which they have been erected.” (Bush, 1945))

A dedicated paper-in-progress explores these challenges and opportunities further in the context of paper-versus cloud-based publications, document-versus-meme-based repositories, individual and institutional curation, digital scholarship, and academic citation systems.

**PKM4D Criteria 12: Technological Progress**

A recent paper (Schmitt, 2014f) looks at human development and argues that the progress of civilization has been primarily shaped by four successive co-evolutions (CE) which resulted in the rises of Embodied and Embrained (CE1), Encapsulated and Encultured (CE2), Encoded and Organizational (CE3), and Digitized, Networked, and Enclouded Knowledge (CE4). At each transitional stage, civilization had been running into constraints which could only be overcome with the emergence of a further powerful co-evolution triggered by the emergence/invention of Learning, Imitation, and Language (CE0-1), Writing, Printing, and Institutional Memory (CE1-2), Digitization, Information and Communication Technology (CE2-3), and Cloud Computing and the Industrial Internet (CE3-4).
The paper considers this over-abundance of information as the presently emerging barrier to individual and collective development. It expects that the prospective realities will further defeat the very attention our cognitive capabilities are able to master - at least until direct access to the Internet through brain implants will allow us to have "the entirety of the world's information as just one of our thoughts" (Shelf, 2004; Stibel, 2009). In the interim, it concludes, autonomous PKMS devices ought to make the crucial next difference by providing the overdue support tools for the problems already faced today and an enabling environment for the creative conversations needed.

Thus, the system-in-progress provides a missing enabler to personal development and people empowerment in the form of an innovative decentralized technology for individuals to engage in Personal Knowledge Management and Creative Conversations. It thrives on the presented KM-related needs and concepts put forward by Bush, Bloom, Maslow, Simon, Andrews, Dawkins, Bjarnekaans, Collis, Grant, Gratton, Hamel, Florida, Gurteen, Johri, Pal, Pollard, Wiig, Levy, Probst, Stewart, Cohen, Boisot, Pirolli, Card, Nonaka, Takeuchi, Ohno, Wierzbinski, Nakamori, and others which can no longer be accommodated based on conventional paradigms and tools.

Interestingly, in reviewing a wider range of features for the ‘Next KM Generation’ (suggested by Sveiby, Wiig, Snowden, McElroy, Ponzi, Miles, St Onge, Allée), the most strongly prioritized among the identified seven key themes are ‘using existing knowledge and creating new knowledge’ as well as ‘the personal and social nature of knowledge’ (Grant & Grant, 2008). The concept proposed is a perfect fit in this regard; it provides a novel and feasible meme-based solution and fully feeds into Levy’s scenario of a decentralized PKM revolution.

The PKMS prototype’s name ‘Knowcations’ is meant as a reference to our knowledge and know-how as well as to the locations and spaces (‘ba’) or the vocations and abilities (vital to further our expertise and careers) and to promote an innovative KM technology for:

- Managing and growing the Intellectual, Social, and Emotional Capital of Individuals,
- Supporting their Creative Authorship throughout their Academic and Professional Careers, anywhere and as Contributors and Beneficiaries of Organizational and Societal Performance, and for
- Fostering Creative Conversations of Teams and Enterprises throughout their Organizational Life Cycles and for Mutual Benefit and Competitive Advantage via Information and Cloud Technologies and Educational Services, as well as for adding productively to the world’s Extelligence.

The Road Ahead

It is planned to transform the prototype into a viable PKM software application within 18 months. The concerns to be further elaborated in further papers – as pointed out – address the issues of integration of ‘individualization’ and ‘institutionalization’ in respect to the next generation of Organizational Knowledge Management Systems and the technological aspects in the context of scholarship, curation and citation systems. A book and an appropriate Training and Service Concept for Personal and Organizational Knowledge Management aimed at Higher Education and Professional Training are further issues in the pipeline.
Acknowledgements

All eleven pictures in Figure 2 are resourced from Flickr, the online photo management and sharing application web site, according to the creative commons license provided by the authors (CC by 2.0, CC BY-SA 2.0). The URLs from top left to bottom right are:


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### Biography

**Ulrich Schmitt**

Ulrich Schmitt's professional background covers positions as IT and management consultant in London and Basle, as professor and vice president at two independent universities in Germany, as well as Vice Rector at the Polytechnic of Namibia and Dean of the Graduate School at the University of Botswana. He studied Management and Industrial Engineering at TU Berlin and Cranfield University, completed his PhD at Basle University, and a Science and Research Management Program at Speyer University. Currently, he is focussing on Personal Knowledge Management and is Professor Extraordinaire at the University of Stellenbosch Business School.

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Strategizing for Mobile Learning: A Holistic Approach for Designing Mobile Learning

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Abstract
Mobile learning provides unique learning experiences for learners in both formal and informal environments, supporting various pedagogies with the unique characteristics that are afforded by mobile technology. Mobile learning, as a growing topic of interest, brings challenges of design for teachers and course designers alike. Current research on mobile learning has covered various aspects such as personalization, context sensitivity, ubiquity and pedagogy. While existing theories and findings are valuable to the understanding of mobile learning, they are fragmented and separate, and need to be understood within the broader mobile learning paradigm.

This paper unifies existing theories into a method for mobile learning design that can be generalized across mobile learning applications. This method develops from a strategy: by seeking objectives, identifying different approaches to learning and understanding the context in which the course will exist. The method helps to guide the content, delivery and structure of the course towards a successful implementation that is evaluated against the initial objectives set out. This paper brings to light the need for more guiding literature that assists teachers in applying the theory around mobile devices and the method proposed is a step in this direction.

Keywords: Mobile learning, Course design, E-learning, Mobile strategy.

Introduction
Mobile learning has been an emerging topic since the introduction of cellular phones and wireless technology; recently this interest has picked up pace due to further technological advances that are making mobile technology simpler and more interesting to use as a means of learning (Burdick & Willis, 2011; Weilenmann & Juhlin, 2011). Mobile learning is the combination of mobile technology and its affordances that create a unique learning environment and opportunities that can span across time and place.

Learning is a form of communication, of transferring knowledge and information, so it makes sense that the most ‘ubiquitous form of communication’ (Franklin, 2011) is used as a tool for learning. What is questioned, however, is not so much whether mobile technology should be used but how it should be used. The uniqueness of mobile learning lies in it being a ubiquitous, social, context sensi-
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tive, and collaborative tool (Ozdamli & Cavus, 2011; Patokorpi, 2006). Various models for understanding mobile learning systems have been created and adapted to measure performance, user acceptance, understand the user’s context, and understand and develop mobile systems and technology (Parsons & Ryu, 2006; Sha, Looi, Chen, Seow, & Wong, 2012; Williams, 2009).

Mobile learning design is the design of a mobile learning course taking into account what needs to be delivered, how it will be done and the structure of such a delivery. This design needs to look at the ‘real needs of instructors and learners’ (Alvarez, Alarcon, & Nussbaum, 2011) and at the social aspects that mobile technology was originally intended for to get the most out of mobile learning. In addition it should consider the ‘as-lived-experience’ of mobile learners (Kjeldskov & Stage, 2012), because in essence learning is deeply social (Burdick & Willis, 2011). However, the determining factor for mobile technologies in learning will be dependent on its adoption by both educators and the learners (Alvarez et al., 2011).

Williams (2009) considers the major element of a successful mobile learning platform to be the instructional design; by simply posting lecture content as-is on the Web, the teacher is not necessarily creating a viable tool for learners. While many universities have provided applications, these have been non-instructional, and thus there is little experience of how to deliver learning through mobile technology (Cheon, Lee, Crooks, & Song, 2012).

Another issue is that “few researchers have discussed ways of integrating mobile devices with web-based learning systems to cover most learning processes by generating a ubiquitous learning environment” (Chen et al., 2008, p.78). Designers and teachers need to have a basic understanding of the various characteristics of mobile learning and how they can best be used. The use of traditional user experience knowledge is insufficient for this as it doesn’t take into account those unique characteristics of mobile learning such as mobility and how smaller screens limit the type of content delivered (Chittaro, 2011; Costabile et al., 2008; Naismith, Lonsdale, Vavoula, & Sharples, 2004).

Where mobile learning is a supporting tool to the classroom, understanding the contexts and teaching concepts are required to effectively implement the system (Alvarez et al., 2011). The theme that arises in the literature is one of understanding: the designer needs to be able to understand and conceptualize all aspects of the mobile learning system to be as effective as possible in delivering the objectives.

This paper consolidates research around mobile learning to create a method for mobile learning design that does not prescribe the content and structure but rather facilitates the process of planning and creating a course while ensuring that the various aspects such as technology, context, usability, and pedagogy are considered along with the objectives of the course. The objective of this research is to create and evaluate a method for mobile learning design from existing mobile and learning theory that can be used by business persons and teachers alike. The research explores the following questions:

- How can the technical aspect of mobile learning research and educational research be combined to get a holistic and effective approach to designing mobile learning?
- What would a method for mobile learning design look like, and what are the steps to follow this method?
- How can an understanding of a mobile user’s as-lived mobile experience be used to maximise the potential of mobile learning?

A design science research methodology was selected as a research approach that allows for the research artefact – a method – to be developed and evaluated in multiple iterations, such that the method can be improved upon constructively. Design science is a creative and generative ap-
proach which is appropriate for the type of contribution that this research is attempting to create. It is important to realize that knowledge is at the core of the research, and in this research the aim is to create prescriptive knowledge from evaluating the identified problem and creating an artefact (method) to address these problems (Baskerville, Kaul, & Storey, 2011; Hevner, March, Park, and Ram, 2004). The next section presents the resulting method with reference to existing literature as its basis.

Method for Mobile Learning

Based on previous research, this section proposes a method for designing mobile learning. Figure 1 outlines the eight phases that will be described in designing and implementing mobile learning. The first five phases (highlighted in orange) illustrate the general design process of considering the context, objectives, pedagogy, the delivery and the structure of the course. The last three phases (highlighted in blue), are the content, implementation and evaluation of the course that are outside of the design of the course and are included as completing the process ensuring that the design meets its objectives. The phases proceed in order as indicated by the arrows. The following sections will describe each phase in detail.

![Figure 1: Phases in designing mobile learning](image)

**Context**

Creating the context around the course is the first step in the method. The context has multiple parts and assists in guiding the designers and teachers as to what is appropriate and expected from the course. For example, if the context is in an impoverished area that does not have high connectivity then it would be unrealistic to use images when text and voice would be easier to access for the learners, whereas a university with good connectivity and access to multiple devices would expect a higher quality of presentation.
Context is an area that needs to be considered and, depending on the category of learning chosen, the context may be more crucial to the success of the course; it ties strongly to the objectives of the course and ‘how’ it will be delivered. Figure 2 presents the Initial considerations in creating context and gives an example of what kinds of questions to ask for each of the contextual areas.

Creating a vision
As an initial step to context, an overall vision should be put into place that will guide the design going forward. This vision should have a purpose. Purpose is important to any design: is the purpose simply to transfer information to a learner or is there a more intrinsic value to the purpose, perhaps to deepen the learner’s understanding or thinking? The vision will provide the complexity of the design and content required.

It is important to note that at any point during the process described here aspects can be changed. So the vision can be changed later as the method develops, and a new aspect comes to light.
Physical and digital sphere

Al-Hmouz et al. (2010) and Koole (2009) described three major categories of context: (1) learner’s personal status that takes into account personal motivation and prior knowledge of the learner; (2) situational context that looks at where the learner is using the course, how often and when and what kind of social environments; (3) learning environment context that is the link between what the device can offer (digital sphere), the content and engagement with the learner.

The physical sphere (learner’s personal and situational context) and the digital sphere are considered individually below and influence each other.

Learner’s personal context

The learner’s context considers aspect of the learner such as preferences, demographic information, and learner history as well as cognitive ability, memory, prior knowledge, emotions and possible motivations (Al-Hmouz, Shen, Yan, & Al-Hmouz, 2010; Koole, 2009). The designer/teacher should ask such questions as:

- What age group is the learners?
- Does the group have any mental/physical disabilities?
- What is the groups experience with the subject and technology?
- What is the learner’s emotional status?
- What are the learner’s reasons for doing this course?

These questions will establish the numerous influences surrounding the learner that can affect his/her behaviour, emotional state and concentration and ultimately his/her ability to use the mobile learning service appropriately. While there is no control over these influences, keeping these in mind when considering the implications of the design will assist in aligning the course to the learner and finding ways to engage the learner that will suit his/her personal context.

Situational context

The nomadic and ubiquitous nature of mobile technology means that a user’s context is constantly changing due to the freedom of movement.

The social/situational context is the actual context in which the learner currently exists as they access or receive learning from a mobile device. It can be defined by the social interactions, cultural surroundings and rules around communication. This context will involve any distractions or interruptions to the learning environment context. Chittaro (2011) points out that using mobile technology can often be a secondary task within our social context - mobile phones have introduced an unpredictability, when one person calls another they are not sure what situation that person is in and cannot know whether they are interrupting that person. It is also a common expectation that someone can answer a call at any time as they will always have access to their phone. The mobile device is then an extension of that person’s situation, so while a user is interacting with the mobile technology they are also involved with “the world as negotiated and enacted in the moment” (Fischer, 2011).

This is an important consideration as it questions how often and how regularly users would engage with their phones for mobile learning. Fischer (2011) also noted that “when users were away from home, they carried their mobile phone with them significantly more often than when at home.” This means that the situational context of a user will often be in a non-constant state; being on the move often means “that people can devote only a very limited attention to the device while they are on the move” (Chittaro, 2011). This brings up an interesting conflict that needs to
be taken into account when designing: even though learners are able to learn on the move there is also a higher chance of distraction and interruptions. Questions to consider in this regard include:

- Whether the learner is in a moving environment? This will affect the length and type of delivery of the course.
- Are there cultural influences on these learners that may impact his/her learning? Some cultures may have a high resistance to the use of technology.
- What are the possible distractions and interactions that the learner might have with the technology being used for the delivery of the course? Think of text messaging, phone calls and other social media that may take preference over learning.
- How often/regularly are the users connected to their devices? If a learner can only get access to the device between certain hours or at a specific place then this will impact the regularity and type of material used on the device.

**Digital sphere and learning environment**

The digital sphere is defined as the device and technology, looking at the functional ability of the device, its physical and technical attributes from the hardware and software. Mobile learning includes the learner’s personal context within a situational context, and these can be considered physical spheres. By introducing the digital sphere into the learning context we have a mobile learning environment.

![Figure 3: Example of creating context](image-url)
The mobile learning context is thus created in the way that it is delivered and the learning styles that it caters for. The mobile learning context is where the situational and learner’s personal context meet with the digital sphere. The learning environment is what will be created by implementing this course and combining these contexts.

In essence, what is being sought is the ‘target audience’ and then looking at how the different contexts of this audience influences the design of the course. Figure 3 provides an example of how the answers may be captured. With these contexts described, the as-lived experience must be addressed to show the relationship between these contexts in creating the learning environment.

**As-lived experience**

As the various contexts are unpacked it becomes simpler to understand where the learning is going to take place. The as-lived experience takes this one step further, in understanding how the learner relates to mobile technology and hence will relate to the mobile learning designed.

The context leads to awareness of the as-lived experience where questions around readiness-to-hand, anticipation of breakdown and the blindness created by design can be offered to assist in usability and consideration of the user in design (Winograd & Flores, 1986).

![Figure 4: As-lived context considerations](image-url)
The as-lived experience provides a look into ‘the opportunities and restrictions created by this mobile learning course’ – as seen in Figure 4. Some of these aspects come from and have been mentioned in the context already created, in understanding the learner, his/her environment and access to technology. The as-lived experience takes this a step further and defines the users relationship to technology and hence the course being created.

Step 5 in the process is about considering the different aspects of the as-lived experience, which may trigger certain requirements around how the course is to be put together and delivered to the learner. In discussing the as-lived experience the designer is looking for ways to create a “Readiness to Hand” (Winograd & Flores, 1986).

The designer is looking to create the course in such a way that it is part of the environment that the learner exists in and is easy to use. The less foreign the implementation the more accessible and effective it may meet its objectives.

Identifying the domain of understanding in which the learner is working will provide information for design of the course that will allow the learner to interact with the course and technology intuitively. Using language and terminology that the learner relates to and understands is one way to ensure an uninterrupted experience to the learner. The learner’s context, gathered in the previous steps, provides information about the learner’s “goals, needs, desires and values” to assist in creating this domain of understanding of how and why the learner connects with technology (Nussbaum, 2001).

The designer should identify the possible ‘blindness in design’ that could come about from using mobile technology as a tool for learning, this means the designer must consider what is being removed that the user would have benefited from in traditional learning and what is being added. This consideration may lead to opportunities for enhancing the course (Winograd & Flores, 1986). An example of blindness in design may be that the course limits discussion that learners would have had in a classroom environment; however this may force the learner to seek more information in their own way. Now that this aspect has been identified, it is possible to decide on whether to intervene or allow it in the course.

**Modules and the depth of mobile learning to be used**

The next step is to split the course into manageable modules. This can be done in many ways and is up to the discretion of the designer. Following the next step is to identify areas where mobile learning is to be used as shown in Figure 5. An overall decision as to whether the mobile learning will be used for the entire course or as a support or reference tool will help in splitting the classroom requirements from the technological ones if necessary.
The classroom requirements would refer to venue bookings, material distribution and what the teacher would require in the physical environment to conduct the class; whereas the technological requirements are specific to the requirements around material, availability and approach using the device. For the purposes of this paper, the technological requirements will be the main focus. For the purposes of illustration, Figure 6 is an example of how this paper might be separated into several modules to be taught using a mobile phone.

Figure 6: Example of separating a course into modules

Figure 7 combines all the steps in creating context together as described above. A holistic context has been considered up to this point, and the designer should have a good idea as to who is receiving the learning, why they are receiving the learning, their domain of understanding and what needs to be taught to the learner.

Figure 7: Complete process of creating context for mobile learning design
Objectives
Identifying objectives, as illustrated in Figure 8, is the next part of the design of the mobile learning course, it is the question ‘why’ are we doing this course and ‘what’ do we want out of it. The objectives should be made with the pedagogical and contextual considerations in mind using Bloom’s Taxonomy (1956) and keeping in mind Franklin’s (2011) high-level objectives of learning, to give access to knowledge, encourage critical thinking and responsibility for learning to the learner. The objectives should not describe the technology - they should be the objectives of the learner, and the technology will need to match in the following steps to see how it can enhance and assist these objectives.

For each module or section of the course the high-level objectives need to be identified. Objectives must be learner oriented, this is to say that it is not about what the technology must do but rather what the learner must obtain from the course. The actual course must then be designed to cater to these objectives. Starting each objective with the words ‘the learner’ helps to orient the objective to what the learner must be able to do at the end of that module of the course (Bloom, 1956).

Figure 8: Steps in creating objectives for mobile learning

It may take some time to unpack the objectives. The modules that have been identified will assist in that they help to focus the attention of the objective, and the area it is specific to. Using Bloom’s taxonomy (1956) will assist with triggering the wording of the objectives. It is important to define these and ensure that they are measurable so as to be able to evaluate the success of the course later on. Objectives will be the crux of the design as it influences all other aspects of design. If a new objective comes to light then all other aspects of design need to be reconsidered.

Each objective must also be given an action, to explain how the objective will be achieved. Mobile characteristics become more important at this point as the designer begins to identify the kinds of activities that will assist in achieving the objective such as creating a discussion forum, an online test or assignment that will be assisted through the technology. The objective here is giving rise to a need that will be met with a mobile function.

Pedagogy
The next few steps as seen in Figure 9 may occur simultaneously with the creation of objectives as they are developed. For each objective identify what the type of knowledge is (e.g. factual) and what cognitive process (e.g. remember) is being used to achieve the objective developed (Merhbi, 2011; Munzenmaier & Rubin, 2013).
The objectives should lead the learner from passive to active learning and into metacognitive thinking where possible. This allows for the educator to further understand the objectives that are being put into place and how it fits into pedagogical theory to ensure that the learning taking place is grounded by these tested theories. When it is visible where the passive and active learning is taking place, the mobile learning platform and its requirements for each of these objectives becomes clearer. For instance, where a more passive approach is being used then providing information to the user is what is required, whereas in a more active learning approach more dynamic mobile learning techniques can be used.

Pedagogy speaks to the learning styles, as shown in Figure 9. It is interlinked with the objectives of the course and ‘how’ it will be delivered. The designer must decide how to cater for the various learning styles through audio, visual and interactive means. Using the main objectives of learning, as outlined by Franklin (2011) to guide the objectives of the course, the designer should be asking how the course is (1) enabling learners to reach their potential by allowing learners to access knowledge beyond the classroom; (2) encouraging critical thinking and problem solving skills; and (3) encouraging learners to take responsibility for their learning. It is also useful to identify in the objectives of the course what category of learning it will be and what that means for how it needs to be designed. Taking Bloom’s taxonomy into account the designer may want to use the overarching objective of moving a learner to a higher level of thinking (Forehand, 2010).

Step 13 involves re-organising the objectives so that gaps can be identified in helping the learner to climb the ladder from passive to active learning. When re-organising the objectives in a grid with the knowledge dimensions as headers and the cognitive processes as the vertical headers, it will be easy to see where there are gaps. Perhaps the course does not take the learner to the cognitive level, or the course is moving too quickly in that it is jumping from remembering to creating without giving the learner time to assimilate and apply the knowledge. In this case new objectives may need to be created or objectives need to be adjusted to give a more fluid learning experience. Looking at what type of knowledge and cognitive processes are being used gaps in the objectives can be identified. Where there is a gap the educator should consider objectives that will improve the course by filling those gaps in the learner’s education (Krathwohl, 2002; Munzenmaier & Rubin, 2013).

At the end of the objectives and pedagogical considerations, the designer may have something like the example in Figure 10. From this example it can be seen how the course is going to achieve its objectives, whether it is a taking into account the multiple cognitive processes of learning according to pedagogy being applied here, and what mobile actions and types of learnings are going to influence the course. It then becomes necessary to consider how the course is to be delivered from what has been identified.
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**Delivery**

The delivery of each module needs to be defined. Delivery asks the question of ‘how’ we are going to get the information to the learners. The context, objectives, and pedagogy that have been considered should trigger how delivery takes place. The steps described in Figure 11 begin with deciding how to deliver the material of the course. Considering the context and objectives created, what aspects will be made available through audio or images. There may be multiple ways of delivering the material.

Step 15 in the process is about considering each of the mobile learning characteristics: ubiquity, nomadicy, social interactivity, personalization, and context sensitivity against each module (Al-Hmouz et al., 2010). The question to be answered is how mobile technology could enhance the delivery of each module with the context and objectives created thus far. It is important that the characteristic is necessary or enhances the learning experience and not just applied for the purposes of applying mobile technology.

With a clearer idea of what the objectives are and what and how it needs to be delivered within a context, Step 16 is to write out the requirements according to what has been decided on thus far. The requirements must provide a clear guideline as to the delivery. An example of a requirement may be that for a particular module the concepts must be displayed visually and when selecting a part of the visual it must provide the written description of it. This still allows the designer of the course to be creative in achieving this but provides a guideline as to what must be the input and result (output).

**Structure**

Structure is ‘when’ the course will deliver the content to meet our objectives within the appropriate context and pedagogical considerations. This should be the final stage of the planning (Figure 12). It includes the timing of the course, bringing in all the previous aspects and monitoring the flow, ensuring it is put together in a way that will guide learners without being restrictive and allowing for the flexibility that the mobile learning environment affords. This can be done visually using a Gantt chart or simply by writing out the requirements and deadlines of the delivery. Some
courses may not have any timelines while others may prescribe reminders and penalties to be put in place.

![Figure 12: Delivery - the final stage](image)

**Content, Implementation and Evaluation**

Content is the ‘what’ is being taught. It’s any research, collecting of necessary information, and resources. It’s not only creating the materials to be delivered but also ensuring that the objectives are met and all necessary information is available and can be made ready for the mobile learning platform, dependent on the contexts and requirements provided. The information made available here will feed directly into the implementation of the course. The content is not part of the overall process of design but rather a part of gathering the necessary information for the actual development of the course.

While implementation and evaluation of the mobile learning course are separate from the design of the mobile learning course, it is important to note that in implementation the aspects of the method are being followed and should be detailed enough to do so. The evaluation phase will also be influenced by the various aspects in the method, as the method allows for generalized areas to evaluate the mobile learning course. The evaluation should also speak directly to the objectives that should have measurable outcomes. Figure 13 combines the steps in the five phases from end-to-end of mobile learning design as discussed in this chapter.

**Summary**

The value in the proposed method is that it brings together various research topics in a structured way, allowing designers to consider the various aspects of a mobile learning course. By going through these steps the designer is able to get a more holistic view and is less likely to only focus on one aspect, such as personalisation, while ignoring other influencing theories. The method is general, in the hope that it can easily be adapted for future research. Figure 14 provides a summary of the phases and the steps within each phase that have been discussed in this chapter.
Figure 13: Process of Mobile Learning Design
Conclusion

By combining the various aspects of mobile learning and the research in these areas, this paper has proposed a method for mobile learning that does not prescribe the content and structure but rather facilitates the process of planning and creating a course while ensuring that the various aspects such as technology, context, usability, and pedagogy are considered along with the objectives of the course. It is hoped that this research can create a central point of reference to more detailed and focused research around mobile learning, allowing for improved mobile learning courses.

The artefact developed in this research addressed the problem that mobile learning, being a relatively new area has had very few attempts at combining and providing a way for a practitioner to use the available information and research in a relevant and holistic manner to design mobile learning. One of the driving forces of this research area is the increase in mobile devices, and access to these devices to all populations of the world. This research has provided a reference point for different areas of research relating to mobile learning from context sensitivity, technological abilities and pedagogical expectations.
The answer to the research questions posed in the introduction can be summarized as follows:

- The different aspects of the mobile learning design were catered for by simplifying the method into phases and further into steps that could be followed sequentially and still influenced each other in creating a holistic view of mobile learning.
- The method is the result of the question being asked and provides a visual representation of how the method works with clear steps to navigate the phases of design considerations.
- The as-lived experience became relevant as part of the context phase, where it reached further into the requirements and objectives of the course. Its consideration of anticipation of breakdown, domains of understanding and blindness in design create an awareness for the designer in continuing with the steps of mobile learning design.

The high-level areas or modules in the method allow for other frameworks and theories to be brought into the method without having to fundamentally change the method, ensuring that each area is covered if only using a different theory within that area. Initial experimentation with the method displayed promise: the sequence of the steps came up as being important to the participant and in gathering the right information to influence the next steps of the method and avoid having to back track too much.

The method proposed has made effort contribution in combining research from mobile learning and pedagogical research into format that is more readily applicable and usable; it is by no means an extensive study but it does provide a starting point. The method includes a focus on mobile learning characteristics that provides a guideline for educators to decide how they will use and deliver their teachings through a mobile device. In this way this paper has addressed its objective to create a method that facilitates the process of planning and creating a course while ensuring various aspects such as technology, context, usability and pedagogy are considered along with the objectives of the course.

Further investigation into this method, its applicability, generalisability and improvement is necessary. To get the most value from this method it needs to be continually reviewed so that it is taking into account the latest theories and technological abilities. It is recommended that this method and its process be more rigorously tested in more experiment cycles in future and further theories integrated into the process succinctly so that it remains accessible and useable.

References


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**Biography**

Genevieve Stanton is Innovations Manager at Pétanque Consultancy in South Africa, consulting in business analysis. She has a Post graduate diploma in Business and Systems Analysis in Management of Information Systems from UCT and is currently completing her Masters in Information Systems. Her current research is in Mobile Learning.

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Perceptions of Mobile ICT Adoption by South Africa Micro Entrepreneurs

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Abstract

The objective of this paper was to determine the perceived barriers and motivators of mobile ICT adoption by South African micro entrepreneurs. Current research shows that mobile ICT can help ensure the success of micro enterprises. However, there are barriers and motivating factors, which influence the mobile ICT adoption rate of micro enterprises and they seem to differ between countries. Semi-structured interviews with a number of South African micro entrepreneurs were used in this study to determine the barriers and motivators relevant in a South African context. The results from this study show that each individual entrepreneur has their own subset of factors, unique to their situation and environment, which influences their ICT adoption rate. Attempts to increase the mobile ICT adoption rate amongst South African entrepreneurs therefore needs to consider the unique set of mobile ICT adoption barriers and motivators that each entrepreneur faces.

Keywords: Entrepreneurs, Micro-enterprises, ICT, Mobile, adoption, Motivators, Barriers

Introduction

South Africa faces a growing unemployment crisis and micro enterprises (MEs) are a vital tool through which the country can address pressing challenges such as job creation and economic growth (Herrington, Kew, & Kew, 2009). According to the National Small Business Amendment Act of South Africa (Republic of South Africa, 2003) a business must not employ more than five people or have an annual turnover of more than R200 000 to be classified as a micro enterprise. This paper will focus only on entrepreneurs with businesses that align to this classification.

Herrington et al. (2009) reports that in 2009 South Africa recorded only 7.2% entrepreneurial activity, in comparison to the 18.8% Global Entrepreneurship Monitor survey average. They have found that many entrepreneurial businesses in South Africa never progress beyond the start-up phase, implying that MEs face many challenges.

One of the ways in which MEs can ensure their success is by making use of Information Communication Technology (ICT), as it is a main contributor to entrepreneurial success and holds many benefits for MEs (Kenny, 2002; Kotelnikov, 2007). Mutula and Van Brakel (2007) for instance recognize ICT as a valuable tool for socio-
economic development. However, despite the value that ICT holds for ME entrepreneurs these technologies are either underutilized or not used at all (Herrington et al., 2009; Ilavarasan & Levy, 2012).

As the usage of ICT at the lower end of the ME spectrum is dominated by mobile telephone usage, this would be the most effective technology to use for MEs, mainly due to its portability (Svanaes, Alsos, & Dahl, 2010). Donner and Escobarí (2010) found voice calls to be the highest rated use of mobile technology and in a study conducted across 13 African countries, it was determined that 76% of small businesses use mobile phones to communicate with their customers, which was much higher than fixed telephone lines or fax machines (Esselaar, Stork, Ndiwalana, & Deen-Swarray, 2006). In that same study 95% of SMEs rated mobile phone as the most desired ICT to be used in their business. Kabanda (2001) found that SMEs prefer using their mobile devices as this ensure and connects them to the “wider, changing social world”. As she rightfully states: “By acquiring this resource (the mobile device) SMEs had the power to change their current practices” (Kabanda, 2001, p. 11). Mobile phones should be seen as “a primary candidate to facilitate participation as part of an e-collaboration effort” (Twinomurinzi, Phahlamohla, & Byrne, 2012, p. 210).

When reviewing the literature on micro entrepreneurs in South Africa, very little could be found on the barriers of mobile ICT adoption.

This paper seeks to identify and address these barriers, which exist in the micro enterprise environment, by making use of the interpretivist paradigm with qualitative data analysis. The perceptions that South African micro entrepreneurs have of mobile ICT, how these perceptions were formed and what other barriers and motivators these entrepreneurs feel influence their adoption of mobile ICT will be explored.

The research questions addressed in this paper are:

- What is currently preventing South African entrepreneurs from using mobile ICT in their businesses?
- Why or for what purposes ME entrepreneurs are currently using mobile technology?
- What are the current perceptions that these entrepreneurs have of mobile information technology

**Literature Review**

**Current Trends and Levels of ICT Use**

Molony (2009) establishes that ICT is a crucial tool with which to build networks and expand an entrepreneurial venture into new markets. His research reveals that Tanzanian entrepreneurs mainly use mobile phones to retain rather than attract clients, by enabling them to strengthen relationships with their existing clients. Donner (2007) has also found that the growth in ICT adoption in developing countries is phenomenal. This is in contrast with Herrington et al. (2009) who asserts that the low rate of ICT adoption could lead to significant growth in the digital divide. Similarly Kirkwood and Price (Kirkwood & Price, 2005) note that even though ICT can be seen as a tool to empower and enhance the people within South Africa, this “advantage” could in fact lead to an even greater “digital divide”. Chibelushi (2008) found that ICT orientated MEs, whom one would assume understand the value of ICT, show lower adoption rates than expected.

Mobile technology, in particular mobile phones, appears to be the most popular ICT used by MEs. Steyn (2011) notes that South African MEs prefer to use mobile phones to communicate with their suppliers as well as customers; and found that more than 70% of the entrepreneurs in
could use their mobile phones to connect to the internet. However, only a small portion of the mobile’s capabilities are currently being used (Chew et al., 2010; Donner, 2007; Ilavarasan & Levy, 2012). Molony (2009) for instance finds that successful Tanzanian MEs only use their mobile devices to call suppliers or to text clients with delivery information. The main reasons for the popularity of mobile phones are found to be its accessibility, affordability and the fact that it requires very little training (Esselaar et al., 2008). One should note that the perception that mobile phones require little or no training, might be the cause for the underutilisation of mobile phone capabilities, as MEs are not trained to exploit its full capabilities.

Esselaar et al. (2008) find that mobile technology provides an easy and flexible means to communicate with suppliers and customers. However, they also find that the promotion of the mobile phone, as the main ICT for MEs, is limiting, since the mobile phone cannot grow and develop as the SME is developing (it cannot be modified or adjusted to suit the changing needs of the ME). Currently, the mobile phone cannot be used to produce income statements, formal letters or brochures. All of which could be produced using any of the recently developed tablet PCs.

**The Impact of ICT on Entrepreneurial Ventures**

ICT is recognised for its potential to contribute to the improvement of performance and competitiveness of business ventures (Morgan et al., 2006) and it is also perceived by many to be a vital tool for businesses (Herrington et al., 2009). There is an increased need for small businesses to leverage the use of ICT to enhance their business as part of the country’s socio-economic development, however, the growing skill shortage regarding how to use ICT is also recognised (Mutula & Van Brakel, 2007; Uddin, 2005). Certain studies have found that information technology variables are insignificant in the success of a start-up (Reid & Smith, 2000). Kotelnikov (2007) and Donner (2004) also caution that not all MEs face the same challenges and therefore, that they do not all need complex or extensive IT solutions, ICT should rather be manipulated to suit each individual’s need. This is very different to most findings (Barba-Sánchez, Martinez-Ruiz, & Jimenez-Zarco, 2007; Bourgouin, 2002; Donner & Escobari, 2010; Matthews, 2007; Tan, Macaulay, & Scheurer, 2006) where authors encourage the use of ICT by MEs, without noting their different and individual needs.

Additionally, Matthews (2007) cautions against accrediting growth in an ME directly to the use of ICT, as there could be other factors, which contribute to the improvement and success of an ME along with ICT. He mentions that it is likely that ICT adoption will only affect growth when accompanied by other changes in the organisation. He also states that the perception of benefits achieved is often greater than when it is measured. Barba-Sánchez et al. (2007) also recommend that other areas of adjustment like organisational structure should be evaluated when determining the strategic value of ICT, and not only the features of newly adopted technologies.

**Factors Affecting the Adoption and Use of ICT**

Morgan et al. (2006) report that there are various difficulties, which prevent MEs from accessing the benefits that ICT offers. However, no two authors identify the exact same list of adoption barriers. To depict this, Table 1 shows the factors that are frequently mentioned by various authors.
Table 1: Factors Influencing ICT Adoption

<table>
<thead>
<tr>
<th>Factor</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unawareness of ICT benefits</td>
<td>(Beggs, 2010; Chibelushi, 2008; Good &amp; Qureshi, 2009; Harindranath, Dyerson, &amp; Barnes, 2008; Mutula &amp; Brakel, 2007; Wolcott, Kamal, &amp; Qureshi, 2008)</td>
</tr>
<tr>
<td>Business skills shortage</td>
<td>(Chandy &amp; Narasimhan, 2011; Wolcott et al., 2008)</td>
</tr>
<tr>
<td>Lack of ICT capabilities and literacy</td>
<td>(Chibelushi, 2008; Kotelnikov, 2007; Fathian, Akhavan, &amp; Hoorali, 2008; Good &amp; Qureshi, 2009; Matthews, 2007; Mutula &amp; Brakel, 2007; Wolcott et al., 2008)</td>
</tr>
<tr>
<td>Lack of tailored solutions for MEs</td>
<td>(Kotelnikov, 2007)</td>
</tr>
<tr>
<td>Expensive and complex products</td>
<td>(Beckinsale, Ram, &amp; Theodorakopoulos, 2010; Esselaar et al., 2008; Harindranath et al., 2008; Kotelnikov, 2007; Morgan et al., 2006; Wolcott et al., 2008)</td>
</tr>
<tr>
<td>Poor communication infrastructure</td>
<td>(Duncombe, 2006; Kotelnikov, 2007; Matthews, 2007; Scott, Batchelor, Ridley, &amp; Jorgensen, 2004; Tenhunen, 2008; Wolcott et al., 2008)</td>
</tr>
<tr>
<td>Employees’ ICT skills shortage</td>
<td>(Kotelnikov, 2007; Wolcott et al., 2008)</td>
</tr>
<tr>
<td>Lack of finances and resources</td>
<td>(Cecchini &amp; Scott, 2003; Chandy &amp; Narasimhan, 2011; Chibelushi, 2008; Donner &amp; Escobari, 2010; Good &amp; Qureshi, 2009; Kotelnikov, 2007; Matthews, 2007; Scott et al., 2004; Wolcott et al., 2008)</td>
</tr>
<tr>
<td>Level of education</td>
<td>(Chew et al., 2010; Chibelushi, 2008)</td>
</tr>
<tr>
<td>Size of ME</td>
<td>(MacGregor, 2004)</td>
</tr>
<tr>
<td>Organisational readiness</td>
<td>(Beckinsale et al., 2010; Chibelushi, 2008)</td>
</tr>
<tr>
<td>Employees pressuring for ICT adoption</td>
<td>(Chibelushi, 2008)</td>
</tr>
<tr>
<td>Lack of time to search for useful ICT</td>
<td>(Chibelushi, 2008; Good &amp; Qureshi, 2009; Morgan et al., 2006; Wolcott et al., 2008)</td>
</tr>
<tr>
<td>Unreliable power supply</td>
<td>(Matthews, 2007)</td>
</tr>
<tr>
<td>Lack of external advice</td>
<td>(Morgan et al., 2006; Wolcott et al., 2008)</td>
</tr>
<tr>
<td>Social and gender norms</td>
<td>(Chew et al., 2010)</td>
</tr>
<tr>
<td>Mistrust and negative attitude towards tech-</td>
<td>(Vickery, Sakai, Lee, &amp; Hagbong, 2004; Wolcott et al., 2008)</td>
</tr>
</tbody>
</table>

Chew et al. (2010) find that the more positive a female entrepreneur feels about her status and power because of her business venture, the more motivated she will be to make use of ICT for business purposes.

Tan et al. (2006) interestingly find that even if some barriers like high costs and lack of government support are removed MEs still tend to be reluctant to adopt ICT. This might be an indication that there are other, yet unknown factors that play a role in adoption.

Research Methodology

Extensive research on the relationship between MEs and their use of ICT was conducted in previous studies. It is also observable that very little research was done to identify the factors, which motivate and prevent South African MEs from using mobile ICT.
This paper will use the Interpretivist paradigm due to the social nature of MEs. Myers (2009) as well as Klein and Myers (1999) note that human sense-making is complex and that one cannot have pre-defined variables when conducting the research. Similarly, Saunders et al. (2003) realises that business situations are unique and complex and that there is a huge focus on the social aspects within which these businesses operate. Due to the fact that the MEs are mostly owned by one owner, who is typically also the decision maker, conducting interpretive research should provide an insight into the perceptions that South African entrepreneurs have of ICT, how these perceptions are formed and how they influence ICT adoption specifically focusing on mobile devices. Semi-structured interviews have been conducted to collect qualitative information. The interview consists of a series of open and closed questions, aimed at obtaining standard demographic data and moving on to the ICT related perceptions and opinions. Each interview contains the same basic questions but allows for expansion or additional questions as each interview progresses.

The target population for this research consists of entrepreneurs in South Africa’s urban areas. The non-probability sampling techniques, purposive and convenience sampling is used to select the sample of ten entrepreneurs from different locations in Pretoria. Based on the criteria of the National Small Business Amendment Act of South Africa (D.O.T.I, 1996) the interviewed entrepreneurs can all be classified as micro entrepreneurs.

Due to the nature of the demographic data, this small portion of the data was analysed by using a quantitative data analysis approach. The rest of the data gathered is qualitatively analysed to ensure that the perceptions, opinions and open-ended questions provide the correct information.

### Data Analysis

The data analysis will now be discussed based on various themes, which emerged from both the literature and the interview questions.

**Adoption Levels of Mobile ICT**

Table 2 outlines the difference between the various levels of adoption based on those specified by Hermana, Sugiharto, and Margianti (n.d.).

<table>
<thead>
<tr>
<th>Level of mobile ICT adoption</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non adopter</td>
<td>No mobile information technology is used.</td>
</tr>
<tr>
<td>Low adopter</td>
<td>One form of mobile ICT is used for basic communication purposes. Typically, a mobile phone is used for communicating with buyers and suppliers.</td>
</tr>
<tr>
<td>Medium adopter</td>
<td>One or more forms of mobile ICT used for basic communication purposes as well as some other functions. Typically, a mobile phone and another form of mobile ICT like a laptop. Additional functions are typically mobile banking.</td>
</tr>
<tr>
<td>High adopter</td>
<td>Multiple mobile ICT forms are used extensively.</td>
</tr>
</tbody>
</table>

Based on the levels in Table 2, it has been found that the interviewed entrepreneurs could be classified as shown in Table 3.
Table 3: Level of mobile ICT adoption

<table>
<thead>
<tr>
<th>Mobile ICT adoption level</th>
<th>Number of entrepreneurs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non adopter</td>
<td>0</td>
</tr>
<tr>
<td>Low adopter</td>
<td>3 (W) 2 (M)*</td>
</tr>
<tr>
<td>Medium adopter</td>
<td>1 (W) 2 (M)</td>
</tr>
<tr>
<td>High adopter</td>
<td>1 (W) 1 (M)</td>
</tr>
</tbody>
</table>

*W = women    M = men

Most of the entrepreneurs are low adopters of mobile technology. Mobile phones are the most popular form of ICT used by all interviewees and only half of them make use of the internet capabilities of their phones. This is in contrast with the findings of Steyn (2011). However, what is clear is that not all interviewees are connected to the internet, which restricts their ability to use a phone for business gain.

Gender of Interviewees

Chew et al. (2010) have found that gender norms play a big role in whether an entrepreneur will adopt mobile technology. The five men are slightly higher adopters of mobile ICT than the five women we have interviewed, reflecting the findings of Chew et al. (2010) to some extent. Certain female entrepreneurs seem to rely heavily on what their husbands think and decide concerning ICT. One interviewee relied on her husband for training and another has turned down the chance to use additional mobile ICT because her husband thinks she does not need it.

Primary space of Business (Location)

Two of the entrepreneurs conduct their business from the grounds surrounding the Union Buildings in central Pretoria, four hawk their wares on the corner of Solomon and Francina streets in the east of Pretoria and three entrepreneurs are located in various parts of Mountain View, north of Pretoria.

Type of Organisation

Kotelnikov (2007) and Donner (2004) found that not all MEs have to use mobile ICT as extensively or have the same ICT needs as others. The type of organisation would therefore contribute to the level of mobile ICT adoption. (See Table 4)

Only three of the interviewed entrepreneurs have service-based businesses and the rest sell goods. Three have a formal business property and seven are classified as street vendors.

Table 4: Type of organisation versus level of adoption

<table>
<thead>
<tr>
<th>Level of adoption</th>
<th>Type of organisation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low adoption</td>
<td>Goods: 5</td>
</tr>
<tr>
<td>Medium adoption</td>
<td>Services: 2 Goods: 1</td>
</tr>
<tr>
<td>High adoption</td>
<td>Services: 1 Goods: 1</td>
</tr>
</tbody>
</table>

Interestingly the service-based businesses have a higher adoption rate than those selling goods. There is also no real difference between street vendors and those with formal businesses in terms of ICT adoption. Two of the street vendors have mentioned that they would make use of more
technology, if they had a safe environment with access to electricity from which to conduct their business.

**Size of your Business in Terms of Employees and Annual Turnover (less than R 200 000)**

This question tries to determine whether organisational size influences the level of ICT adoption (MacGregor, 2004). MacGregor (2004) has found that smaller firms lack the skills and capital to be high level adopters.

The two high adopting MEs interviewed employ only the owner, while the majority of low adopters employ three to five people. This contrasts with MacGregor’s (2004) findings that the larger the organisation, the higher its adoption. One must note, however, that his research has focused on large organisations. What could be true for these findings is that the two high adopters have a bigger workload, due to working alone, while realising the need to communicate with their suppliers and certain customers resulting in the increased use of Mobile ICT to work smarter and more efficient.

**Highest Level of Education**

A person’s level of education plays a major role in the adoption of ICT in their businesses (Chew et al., 2010; Chibelushi, 2008). Table 5 shows the level of education of each entrepreneur alongside their level of mobile ICT adoption.

<table>
<thead>
<tr>
<th>Highest level of education</th>
<th>Mobile ICT adoption level</th>
<th>Number of entrepreneurs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grade 10</td>
<td>Low adopter</td>
<td>1</td>
</tr>
<tr>
<td>Grade 12</td>
<td>Low adopter</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>Medium adopter</td>
<td>1</td>
</tr>
<tr>
<td>Qualified fitter and turner diploma</td>
<td>High Adopter</td>
<td>1</td>
</tr>
<tr>
<td>Degree</td>
<td>Medium adopter</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>High adopter</td>
<td>1</td>
</tr>
<tr>
<td>Honours degree</td>
<td>Medium adopter</td>
<td>1</td>
</tr>
</tbody>
</table>

Table 5 shows that the higher the entrepreneur’s level of education, the more likely they are to have a higher level of mobile ICT adoption. This supports the findings by Chibelushi (2008) and Chew et al. (2010).

**Primary Use of Mobile ICT device**

Chew et al. (2010) state that MEs only use a portion of a mobile phone’s capabilities. Various findings support this statement, with mobile phone use being limited to contacting suppliers and clients and sometimes finding information via the internet (Chew et al., 2010; Donner & Escobari, 2010; Esselaar et al., 2008; Tenhunen, 2008). Molony (2009) also finds that MEs use mobile phones to retain rather than attract clients.

The micro entrepreneurs in this study responded as shown in Table 6:
Table 6: Uses of mobile ICT

<table>
<thead>
<tr>
<th>Use of mobile ICT</th>
<th>Number of entrepreneurs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Communication with clients</td>
<td>7</td>
</tr>
<tr>
<td>Mobile banking</td>
<td>1</td>
</tr>
<tr>
<td>Communication with suppliers</td>
<td>7</td>
</tr>
<tr>
<td>Communication with employees</td>
<td>2</td>
</tr>
<tr>
<td>Coordinating deliveries and orders</td>
<td>4</td>
</tr>
<tr>
<td>Mobile advertising</td>
<td>1</td>
</tr>
</tbody>
</table>

The fact that some entrepreneurs make use of mobile banking and mobile advertising in addition to the basic communication with suppliers and customers is the only difference to existing research findings. It was also clear during the interviews that the entrepreneurs’ focus was on client retention and not attraction, when it came to the use of ICT, which supports Molony’s (2009) findings. What is also interesting is the fact that MEs use mobile phone primarily to communicate with customers and suppliers, which supports Steyn’s (2011) findings.

Level of Computer Literacy

The lack of computer literacy is one of the biggest barriers to mobile ICT adoption (Chichelushi, 2008; Fathian, Akhavan, & Hoorali, 2008; Good & Qureshi, 2009; Kotelnikov, 2007; Matthews, 2007; Mutula & Brakel, 2007; Wolcott et al., 2008). One assumes that a computer-literate person will be more aware of the benefits of ICT and thus be more likely to adopt it (Beggs, 2010).

Two of the female entrepreneurs have no experience with computers and one of the males says he knows a little about computers, but that he would not describe himself as literate. Two of the entrepreneurs have attended computer courses and two are being, or have been, taught by a friend or spouse. Three of the entrepreneurs (all male) are literate because it was or is a requirement for their previous or current job. Interestingly, the majority of the entrepreneurs who feel that they are computer literate are low adopters, contrasting with existing research findings. The main problem may be that this question is based on the entrepreneur’s belief of whether they are computer literate or not and that their literacy level has not been objectively tested. When one studies the reasons why they believe they are literate, one sees that they have different opinions on what computer literacy means. One of the low adopters who believes he is computer literate only recently started attending a computer course and another was taught the basics of Word and e-mail use by her husband. One medium adopter says he can help himself “around a computer”, but he believes this hardly means he is computer literate. Another of the computer literate, low adopters does not trust ICT at all, which overrides the knowledge of the advantages he has as a computer literate person. If one considers this, the results are more in line with the “computer literacy equals higher adoption” trend in current research.

Keeping Up to Date with the Latest Technology Trends

As mentioned before Beggs (2010) has found that one of the main barriers to mobile ICT adoption is the unawareness of the benefits of ICT. Four of the respondents say they do not try to keep up with the latest technology trends. One comment made was, “I am not interested in it and I don’t think it is necessary”. The majority of the respondents do keep up with the latest trends and here are some of their responses:

"I learn from my children"
"I listen to what friends and family say about it"
"I follow the news"
"I do research on new technology trends"

Only one of the entrepreneurs who say that he keeps up to date with technology makes an effort to ensure that he has the latest information about technological developments; it is interesting to note that he is also a high mobile ICT adopter. This seems to indicate that staying abreast of what is happening in the world of technology may increase ICT adoption.

**Were You Exposed to Mobile ICT while Growing Up? Why or Why Not?**

This question aims to determine whether an entrepreneur’s mobile ICT adoption level is influenced by their surroundings while growing up and what level of exposure they have had to ICT at a young age. Six of the entrepreneurs have had no exposure to ICT while growing up, one has been the first user of a mobile phone in his family and only one has had extensive exposure to technology while growing up at school and university.

It seems that there is some correlation between the person’s early exposure to mobile ICT and their level of adoption. Those that have had exposure to the use of mobile technology in a business context at a younger age are all medium and high adopters.

**Do You Know of Other Entrepreneurs Who Use Mobile ICT as Part of Their Businesses?**

This question aims to determine if an entrepreneur’s exposure to the use of mobile ICT by other entrepreneurs affects their own adoption level.

Four of the entrepreneurs know someone who uses mobile ICT in their businesses. Of the four, two are high adopters, one a medium and one a low adopter. The majority of the low adopters as well as two of the medium adopters do not know anyone who uses mobile ICT in their businesses.

This clearly implies that entrepreneurs who have exposure to or knowledge about how others use mobile ICT in their businesses are more likely to adopt mobile ICT themselves.

**Feelings and Thoughts on the Use of Mobile ICT for Business Purposes**

Generally, there seems to be a very positive attitude towards mobile ICT and many entrepreneurs mention the benefits it holds (Table 7). These results seem to indicate that providing training and access to mobile ICT would increase the chances of adoption.
Table 7: Opinions on mobile ICT

<table>
<thead>
<tr>
<th>Opinion</th>
<th>Reasons</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Male</strong></td>
<td></td>
</tr>
<tr>
<td>Low adopter: &quot;It empowers me and helps me to communicate more effectively.&quot;</td>
<td>&quot;I know this from watching how others use it and from my own experiences with it.&quot;</td>
</tr>
<tr>
<td>Low adopter: &quot;It is a good thing, but it makes people lazy.&quot;</td>
<td>&quot;Personal experience in my previous position. Computers make people lazy and they trust everything the computer tells them, without checking that it is correct.&quot;</td>
</tr>
<tr>
<td>Medium adopter: &quot;I would not be able to survive without it.&quot;</td>
<td>&quot;I have seen that it makes you immediately available to people.&quot;</td>
</tr>
<tr>
<td>Medium adopter: &quot;I think it is a good thing; you would not be able to survive without it.&quot;</td>
<td>&quot;Technology has improved immensely and I believe you can achieve a lot with it.&quot;</td>
</tr>
<tr>
<td>High adopter: &quot;It is a very good thing.&quot;</td>
<td>&quot;I know this from my experience in the IT industry.&quot;</td>
</tr>
<tr>
<td><strong>Female</strong></td>
<td></td>
</tr>
<tr>
<td>Low adopter: &quot;I think it is important&quot;</td>
<td>&quot;Without it I will not be able to conduct business when it is raining.&quot;</td>
</tr>
<tr>
<td>Low adopter: &quot;It helps me to make my business much better.&quot;</td>
<td>&quot;I have seen that it makes life easier for my customer who can call me instead of driving to my stall.&quot;</td>
</tr>
<tr>
<td>Low adopter: &quot;It is very helpful, because it reduces time and effort in my business.&quot;</td>
<td>&quot;I have seen that it makes things easier.&quot;</td>
</tr>
<tr>
<td>Medium adopter: &quot;If I had more skills I would use it, because it helps make your business better.&quot;</td>
<td>&quot;I think it is good, but if I had training I would know for sure seeing as I would use it more.&quot;</td>
</tr>
<tr>
<td>High adopter: &quot;I think mobile technology is nice.&quot;</td>
<td>Based on personal experience using mobile ICT</td>
</tr>
</tbody>
</table>

**Have You Seen Any Advantages of Using Mobile Technology in Your Business? If So, Can You Explain in More Detail?**

As shown in Table 8, there are various benefits associated with the use of mobile ICT in a business (Chibelushi, 2008; Kotelnikov, 2007; Morgan et al., 2006; Molony, 2009).
Table 8: Benefits of mobile ICT

<table>
<thead>
<tr>
<th>Adoption level</th>
<th>Perceived benefits</th>
</tr>
</thead>
</table>
| High adopters  | • Enables quick and easy communication  
• It is convenient and reliable  
• It makes you accessible anytime and anywhere and improves communication                                                                                                                                                                                                                     |
| Medium adopters| • "It provided me with an advantage over my competitors initially when I was one of the first to use it in my business."  
• Improved communication  
• It makes you accessible 24 hours of the day  
• It makes things easier  
• "My communication and finances are managed easier and more efficiently."                                                                                                                                                                                                                       |
| Low adopters   | • "I can contact my customers anytime and anywhere."  
• "It enables me to find and keep clients, provide a better service and organize my business better."  
• "Makes things easier and quicker and I can monitor my bank transactions."  
• "I think it is a nuisance although it makes it easier to communicate and you can contact people anytime."  
• "It helps me keep my customers for longer."                                                                                                                                                                                                                                                    |

It was interesting to note that one of the low adopters mentioned cell phone banking as an advantage, but they do not make use of it themselves. In general, the low adopters named more benefits than the high adopters did. This could indicate that the low adopters are aware of the benefits and want to use mobile ICT, but that adoption barriers prevent them.

**What Prevents You from Making Use of Mobile ICT?**

Table 9 lists the barriers identified by the interviewed entrepreneurs as well as the references to current research, which identify the same barrier.

Table 9. Barriers identified by entrepreneurs

<table>
<thead>
<tr>
<th>Barrier</th>
<th>No of entrepreneurs</th>
<th>Similar barrier in literature</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>It is too expensive</td>
<td>4</td>
<td>Expensive and complex products</td>
<td>(Beckinsale, Ram, &amp; Theo&amp;orakopoulos, 2010; Esselaar et al., 2008; Harindranath et al., 2008; Kotelnikov, 2007; Morgan et al., 2006; Wolcott et al., 2008)</td>
</tr>
<tr>
<td></td>
<td>(All low adopters)</td>
<td>Lack of finances and resources</td>
<td>(Chandy &amp; Narasimhan, 2011; Chibebshi, 2008; Cecchini &amp; Scott, 2003; Donner &amp; Escobari, 2010; Good &amp; Qureshi, 2009; Kotelnikov, 2007; Matthews, 2007; Scott et al, 2004; Wolcott et al., 2008)</td>
</tr>
<tr>
<td>Barrier</td>
<td>No of entrepreneurs</td>
<td>Similar barrier in literature</td>
<td>Reference</td>
</tr>
<tr>
<td>------------------------------------------------------------------------</td>
<td>---------------------</td>
<td>-----------------------------------------------------</td>
<td>---------------------------------------------------------------------------</td>
</tr>
<tr>
<td>I have no skills or knowledge about ICT; I have never tried it before</td>
<td>4 (Three low and one medium adopter)</td>
<td>Unawareness of ICT benefits</td>
<td>(Beggs, 2010; Chibelushi, 2008; Good &amp; Qureshi, 2009; Harindranath et al., 2008; Mutula &amp; Brakel, 2007; Wolcott et al., 2008)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Lack of ICT capabilities and literacy</td>
<td>(Chibelushi, 2008; Fathian, Akhavan, &amp; Hoorali 2008; Good &amp; Qureshi, 2009; Kotelnikov, 2007; Matthews, 2007; Mutula &amp; Brakel, 2007; Wolcott et al., 2008)</td>
</tr>
<tr>
<td>I do not have access to mobile ICT and infrastructure</td>
<td>1 (Low adopter)</td>
<td>Poor communication infrastructure</td>
<td>(Duncombe, 2006; Kotelnikov, 2007; Matthews, 2007; Scott et al., 2004; Tenhunen, 2008; Wolcott et al., 2008)</td>
</tr>
<tr>
<td>I have no transport to get to ICT training</td>
<td>1 (Low adopter)</td>
<td>Lack of ICT capabilities and literacy</td>
<td>(Chibelushi, 2008; Fathian, Akhavan, &amp; Hoorali 2008; Good, &amp; Qureshi 2009; Kotelnikov, 2007; Matthews, 2007; Mutula &amp; Brakel, 2007; Wolcott et al., 2008)</td>
</tr>
<tr>
<td>I do not believe that it is necessary for my business; I do not see the use of it.</td>
<td>3 (One low adopter and two medium adopters)</td>
<td>Unawareness of ICT benefits</td>
<td>(Beggs, 2010; Chibelushi, 2008; Good &amp; Qureshi, 2009; Harindranath et al., 2008; Mutula &amp; Brakel, 2007; Wolcott et al., 2008)</td>
</tr>
<tr>
<td>I just don't like or trust it. There are too many issues and faults associated with it.</td>
<td>1 (Low adopter)</td>
<td>Mistrust and negative attitude towards technology</td>
<td>(Vickery et al., 2004; Wolcott et al., 2008)</td>
</tr>
<tr>
<td>The area from which I conduct business prevents me from using more mobile ICT, there is no electricity and it is not safe.</td>
<td>2 (Both are high adopters)</td>
<td>Unreliable power supply</td>
<td>(Matthews, 2007)</td>
</tr>
</tbody>
</table>

Similar to most of the current literature the cost of mobile ICT was one of the top barriers amongst the interviewed entrepreneurs. Noticeably only low adopters mentioned cost as a barrier. It is also interesting that two of the entrepreneurs feel that mobile ICT is not too expensive and that you can find mobile ICT, which will suit your pocket.

One entrepreneur believes that he does not need mobile ICT seeing as his business is small, he feels he would use mobile ICT more if his business was bigger. Another has stated that she is not sure why she does not use more mobile ICT as she has the intention to, but never follows through on her plans. The two high adopters have both only named one barrier, the fact that their location is not secure and does not have electricity access.
What Would Motivate You to Use More Mobile ICT?

Tan et al. (2006) found that even when certain barriers to ICT adoption are removed, entrepreneurs may still not adopt ICT. This indicates that removing barriers on their own is not enough to promote adoption; one must motivate entrepreneurs to utilize mobile ICT (Table 10).

Table 10: Motivators of mobile ICT adoption

<table>
<thead>
<tr>
<th>Motivator</th>
<th>No of entrepreneurs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Training</td>
<td>5</td>
</tr>
<tr>
<td>Someone to ask for advice</td>
<td>1</td>
</tr>
<tr>
<td>“If it was less expensive and I could afford it.”</td>
<td>3</td>
</tr>
<tr>
<td>“If I had access to a safe environment with electricity access.”</td>
<td>1</td>
</tr>
<tr>
<td>“I don’t think my business can benefit from mobile ICT so nothing will motivate me to use it.”</td>
<td>1</td>
</tr>
<tr>
<td>“If my business was bigger, that would motivate me to use it. I need ICT to manage a big business not to get it to grow.”</td>
<td>1</td>
</tr>
<tr>
<td>“I can’t think of anything.”</td>
<td>1</td>
</tr>
</tbody>
</table>

Lower prices and training came up most often as sources of motivation to adopt mobile ICT.

If You Could Obtain Cheap and Easy Access to Mobile ICT, Would You Make Use of It For Business Purposes? Why or Why Not?

Tan et al. (2006) have found that many entrepreneurs feel they would not necessarily increase their ICT adoption when it is made more accessible and less expensive. Two of the respondents had no interest in using it, the rest said yes. Some of the comments are: "The cost currently prevents me from using it"; "It would enable me to get more for less to improve my business."; "It would enable me to make my business more functional."

These findings support those of Tan et al. (2006) to some extent, seeing as two of the entrepreneurs have no interest in increasing their mobile ICT adoption even if it is provided at a lower rate and made more accessible. One of them is of the opinion that he does not need any other mobile technology than what he is currently using; he would just upgrade the existing technology. The other one is very mistrustful of technology.

Quite a few people state cost as a barrier to adoption, but add that they would use more mobile ICT if it were cheaper. This might be an indication that entrepreneurs are unaware of what exactly prevents them from using mobile ICT.

Do You Trust ICT? If Not Why Not?

Wolcott et al. (2008) and Vickery et al. (2004) state that many entrepreneurs mistrust or have a negative attitude towards mobile ICT.

Only three entrepreneurs state that they trust mobile ICT. The rest all reply that they only trust it to some extent. Some of the reasons why they mistrust ICT are that people make mistakes while using mobile ICT, others misuse mobile ICT for crimes like identity theft and one entrepreneur does not trust doing mobile banking because of the high fraud rates.
**Who Helps You Decide What Technology to Use?**

Table 11 shows who respondents ask for advice.

<table>
<thead>
<tr>
<th>Source of advice</th>
<th>No of entrepreneurs</th>
</tr>
</thead>
<tbody>
<tr>
<td>&quot;I ask friends.&quot;</td>
<td>2</td>
</tr>
<tr>
<td>&quot;I consult with people I know are knowledgeable about ICT.&quot;</td>
<td>2</td>
</tr>
<tr>
<td>&quot;I ask my husband for advice.&quot;</td>
<td>2</td>
</tr>
<tr>
<td>&quot;I ask my uncle or other family members for advice.&quot;</td>
<td>1</td>
</tr>
<tr>
<td>&quot;I do research and decide on my own.&quot;</td>
<td>3</td>
</tr>
<tr>
<td>&quot;I consult with my business partners.&quot;</td>
<td>1</td>
</tr>
<tr>
<td>&quot;I have no one I can ask for advice.&quot;</td>
<td>1</td>
</tr>
</tbody>
</table>

Something that points to the gender norms barrier identified by Chew et al. (2010) is that one of the female entrepreneurs has had a chance to obtain a laptop, but her husband declined it, because she did not need it according to him. She accepts this decision, despite the fact that she feels she could benefit from a laptop.

**Research Findings**

The research questions will now be answered based on the findings obtained through analysis of the interview data.

**What is Currently Preventing South African ME Entrepreneurs from Using Mobile ICT in Their Businesses?**

During the interviews various barriers have been identified by the entrepreneurs themselves and others and have become apparent during the data analysis. Based on the data, Table 12 lists barriers currently preventing South African ME entrepreneurs from using mobile ICT in their businesses. The references to existing research, which identifies similar barriers, are listed next to the relevant barrier.

<table>
<thead>
<tr>
<th>Barrier</th>
<th>Research findings</th>
<th>Related research</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unawareness of ICT benefits</td>
<td>Entrepreneurs who keep themselves informed about the latest trends and benefits of technology tend to be high adopters of mobile ICT. Many entrepreneurs do not see the benefit that mobile ICT holds or they believe that their businesses do not need mobile ICT.</td>
<td>(Beggs, 2010; Chibelushi, 2008; Good &amp; Qureshi, 2009; Harindranath et al., 2008; Mutula &amp; Brakel, 2007; Wolcott et al. 2008)</td>
</tr>
<tr>
<td>Business skills shortage</td>
<td>The research shows a correlation between the rate of mobile ICT adoption and a high level of business training.</td>
<td>(Chandy &amp; Narasimhan, 2011; Wolcott et al., 2008)</td>
</tr>
<tr>
<td>Barrier</td>
<td>Research findings</td>
<td>Related research</td>
</tr>
<tr>
<td>--------------------------------</td>
<td>-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
<td>------------------------------------------------------------------------------------------------------</td>
</tr>
</tbody>
</table>
| Lack of ICT capabilities and literacy | Computer illiterate entrepreneurs have a lower mobile ICT adoption rate than literate entrepreneurs do. If you do not know how to use mobile ICT, you are less likely to know about its benefits and why you should adopt it.  
Many micro entrepreneurs believe themselves to be computer literate, while they are not. This is a problem, as they see no need to attend computer training, reducing their chances of adopting more mobile ICT.  
Many entrepreneurs also state that lack of training on how to incorporate mobile ICT in their businesses, prevents them from using it more. | (Chibelushi, 2008; Fathian, Akhavan, & Hoorali, 2008; Good & Qureshi, 2009; Kotelnikov, 2007; Matthews, 2007; Mutula & Brakel, 2007; Wolcott et al., 2008)                                                                                                                                  |
| Expensive and complex products   | Many MEs see this as a main barrier to adoption.                                                                                                                                                                                                                                                                                                        | (Beckinsale, Ram, & Theodorakopoulos 2010; Esselaar et al., 2008; Harindranath et al., 2008; Kotelnikov, 2007; Morgan et al., 2006; Wolcott et al., 2008)                                                                                           |
| Poor communication infrastructure | Entrepreneurs in the remote areas struggle to gain access to reliable communication services.                                                                                                                                                                                                                                                        | (Duncombe, 2006; Kotelnikov, 2007; Matthews, 2007; Scott et al. 2004; Tenhunen ,2008; Wolcott et al., 2008)                                                                                                          |
| Lack of finances and resources   | Many MEs see this as a main barrier to adoption.                                                                                                                                                                                                                                                                                                        | (Cecchini & Scott, 2003; Chandy & Narasimhan, 2011; Chibelushi, 2008; Donner & Escobari, 2010; Good & Qureshi, 2009; Kotelnikov, 2007; Matthews, 2007; Scott et al., 2004; Wolcott et al., 2008) |
| Level of education               | The more educated micro entrepreneurs are, the more likely they are to be high mobile ICT adopters, possibly because computer training is currently included in most forms of education.                                                                                                                                                                      | (Chew et al., 2010; Chibelushi, 2008;)                                                                                                                         |
| Unreliable power supply         | Many micro entrepreneurs state that they would use more mobile ICT if they had access to a power source at their business location.                                                                                                                                                                                                                      | (Matthews, 2007)                                                                                                                                                |
Perceptions of Mobile ICT Adoption by South Africa Micro Entrepreneurs

<table>
<thead>
<tr>
<th>Barrier</th>
<th>Research findings</th>
<th>Related research</th>
</tr>
</thead>
<tbody>
<tr>
<td>No external advice</td>
<td>Micro entrepreneurs, who do not have someone to consult about business technology, tend to have a low adoption rate.</td>
<td>(Morgan et al., 2006; Wolcott et al., 2008)</td>
</tr>
<tr>
<td>Social and gender norms</td>
<td>Men tend to be slightly higher adopters of mobile ICT than women are and some of the women who were interviewed allow their husbands to make choices for them concerning the use of mobile ICT in their business. In one case, a woman’s husband turned down mobile ICT that she feels she really needs for her business and she has accepted his decision.</td>
<td>(Chew et al., 2010)</td>
</tr>
<tr>
<td>Mistrust and negative attitude towards technology</td>
<td>Many people still do not trust technology for reasons like the fact that you cannot trust people to use mobile ICT honestly and without making any mistakes.</td>
<td>(Vickery et al., 2004; Wolcott et al., 2008)</td>
</tr>
<tr>
<td>Type of organization</td>
<td>Businesses that sell goods tend to be higher adopters of mobile ICT than service based businesses.</td>
<td>No current research was found.</td>
</tr>
<tr>
<td>Location of business is not safe or secure.</td>
<td>Entrepreneurs state that they would adopt more mobile ICT if they had a safe environment from which to conduct their businesses.</td>
<td>No current research was found.</td>
</tr>
</tbody>
</table>

From Table 12 one can see that many of the barriers identified in current literature are applicable to South African entrepreneurs, although many others have not appeared in the course of the research done for this paper.

Two new barriers are identified during the course of this research paper:

- It appears that the type of business in itself can be a barrier to mobile ICT adoption. Micro entrepreneurs with service-based businesses had a much higher adoption rate than those entrepreneurs with businesses that sell goods.
- Some entrepreneurs have indicated that they do not feel the area they conduct their business in is safe and secure enough. They do not use multiple forms of mobile ICT as they cannot carry all of these to their business location, they have no place to store it overnight and they do not want to risk having their mobile ICTs stolen.

It is also important to note that most micro entrepreneurs’ mobile ICT adoption level is determined by a combination of barriers. It would therefore be difficult to create one fool proof solution to improve the adoption level of all micro entrepreneurs in South Africa.

- Why or for what purposes are ME entrepreneurs currently using mobile technology?

Currently mobile phones are the most popular form of mobile ICT for micro entrepreneurs (Herrington et al., 2009), although only a small section of the mobile phone's full capabilities are being used. Only a small number of entrepreneurs utilises the internet access that their phones provide and very few make use of any other phone capability except texting and phone calls.

The main uses for mobile phones by South African entrepreneurs are as follows:
• Communication with employees, clients and suppliers
• Coordinating deliveries and orders
• Mobile banking
• Mobile advertising

These entrepreneurs make use of mobile ICT as they see various benefits in the use of these devices. They also feel pressured by competitors, clients and friends to use mobile ICT to run their businesses.

What are the Current Perceptions that These Entrepreneurs Have of Mobile Information Technology?

In general, the majority of entrepreneurs have a very positive attitude towards and opinion of mobile ICT. They state that it empowers them, that they would not be able to survive without it and that it helps them make their businesses more effective. Both low and high adopters are able to list a number of benefits that they feel mobile ICT holds for a business.

It is interesting to note that although many entrepreneurs could list benefits of using mobile ICT there are those that do not use it, despite awareness of its worth. One such entrepreneur does not approve of the use of mobile ICT as, according to him, it “makes people lazy.” The majority of South African entrepreneurs also state that they trust ICT but not the people who use ICT. Many list fraud, mistakes and identity theft as reasons why they cannot trust ICT outright.

Most of these perceptions are based on personal experience with the use of mobile ICT in a business context or training. One of the entrepreneurs has stated that they would probably have a higher opinion of mobile ICT if they receive training, as this would enable them to make an educated decision on the worth of mobile ICT in a business.

The negative perceptions that many entrepreneurs have of mobile ICT is a major obstacle in increasing the adoption of mobile ICT.

Research Limitations

There are various limitations, which have influenced the outcome of this research paper. The fact that only ten entrepreneurs have been interviewed could mean that important barriers were overlooked. The entrepreneurs also come from the same area so that it is difficult to generalise the data to all South African entrepreneurs.

Additionally the researchers had to face challenges in finding a classification method for adoption of mobile ICT amongst micro entrepreneurs. There is no current literature on how to rate or scale the level of adoption of an entrepreneur. Research to develop a framework by which one can determine the extent or complexity of ICT, that a specific ME requires, may be valuable. An in-depth study on the current uses of mobile technology by MEs and how to redirect these to become more business orientated could also prove to be worthy.

Conclusion

From the findings, one can see that there are various internal and external forces that determine the level of mobile ICT adoption by South African entrepreneurs. Many of these factors are not unique to South African entrepreneurs as one can see from the literature. Each entrepreneur has their own unique mix of factors, which influences their adoption.
These findings contribute to the knowledge on how South African micro entrepreneurs can be encouraged to adopt more mobile ICTs in order to grow their businesses and benefit the economy of the country.

References


Wolcott, P., Kamal, M., & Qureshi, S. (2008). Meeting the challenges of ICT adoption by micro-

**Biographies**

**Eunice Steyn** matriculated in 2008 at the high school Wonderboom (South Africa). After high
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vision to be a proactive force for positive change. Eunice also serves as the Vice President of The
Association of Allan Gray Fellows a start-up community aimed at providing entrepreneurial and
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information technology has and can have on improving leadership, entrepreneurship and small
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**Riana Steyn** matriculated in 2000 in South Africa. After school she
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within small companies and entrepreneurs and how IT can be used to
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model to assist the South African to adopt ICT effectively.

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degree in Computer Science and a PhD(Informatics) degree. She
started her career in 1979 as a junior lecturer at the University of South
Africa and joined the University of Pretoria as an associate professor
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Technology, consisting of three departments, from 2002 to 2005. She
has co-authored 9 books, 26 articles in peer-reviewed international
journals and delivered more than 90 international and national
conference papers on different topics in Information Systems and IS Education. She is a member
of several international bodies and serves on a number of editorial and advisory boards for
journals, including IT for Development and AIS Transactions for HCI. She holds a National
Research Foundation rating as an established IS researcher since 2000. The Department of
Informatics received ABET accreditation under her leadership in 2008, one of the first
departments outside the USA.
The Range and Level of Software Development Skills Needed in the Western Cape, South Africa

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Abstract

Information Technology (IT) skills are in high demand in South Africa but currently, there appears to be a poor supply of these relevant skills as positions are not easily filled. The purpose of this study was to determine the range and level of skills required for software development work in the Western Cape and to ascertain the challenges faced by companies while trying to fill these positions. The research objectives are to (1) determine the range and level of software development skills needed in the Western Cape to meet industry demands, (2) determine the availability of relevant software development skills in the Western Cape as per industry demand, and (3) identify the challenges faced by industry while recruiting software developers in the Western Cape. Findings of the study is intended to inform the development of a University of Cape Town (UCT) approved qualification, for commencement by 2015, based on the gaps identified in the market.

Keywords: Software Development Skills, Western Cape, South Africa Skills Demand, Skills Gap.

Introduction

In May 2014, the top 100 occupations in demand in South Africa and the national scarce skills list were published by Higher Education Minister Blade Nzimande (“Scarcest IT skills in South Africa,” 2014). Systems analysts and software developers were listed as the top two Information Technology (IT) related professions in high demand in South Africa (“Scarcest IT skills in South Africa,” 2014). The growing demand for IT skills in South Africa has been noticeable for the past few years. In 2011, the Career Junction Index ranked positions in the IT sector as the fourth most difficult to fill (CareerJunctionIndex, 2011). The ITWeb-JCSE Skills Survey (2011) further amounted the demand for IT workforce to 20 000 to 30 000 job opportunities. In 2014, CareerJunctionIndex ranked the demand for IT skills as the highest and but also most difficult types of positions to fill (Career Junction Index, 2014).

This trend is also visible in Africa. In January 2014, IBM published the findings from their study whose goal was to understand how IT leaders can deliver on the strategic potential of emerging technologies by addressing key adoption challenges. Their study identified that even though 87% of African IT leaders...
recognize the importance of emerging technologies only 34% are adopting such technologies (“Setting the Pace in Africa,” 2014). Moreover, the study specifies that the lack of IT skills as well as the inability to attract and retain skilled IT professionals as one of the reasons for this poor adoption rate (“Setting the Pace in Africa,” 2014). In particular, less than half of the surveyed companies developed the adequate level of IT skills needed to bridge the technology adoption gap and both expertise and technology are required to maintain companies’ competitiveness (“Setting the Pace in Africa,” 2014).

Globally, the overall picture is no different. In 2010, Singapore’s ICT sector reported 16,100 vacancies which they attributed to lack of career advancement opportunities and unattractive salary packages (“ITWeb-JCSE Skills Survey,” 2011). In 2011, Dice.com reported around 83,000 ICT related vacancies in the US, which they attributed to a high demand for mobile applications (“ITWeb-JCSE Skills Survey,” 2011).

Currently in 2014, not only is the demand for ICT skills high in South Africa, there also appears to be a poor supply as these positions are not easily filled (Career Junction Index, 2014). In addition, the unemployment rate in the country in 2014 increased to 25.20% from the fourth quarter of 2013 (Trading Economics, 2014). However, there is evidence that people with the right skills in the right locations are finding employment (“ITWeb-JCSE Skills Survey,” 2011). For example, Microsoft successfully trained and placed in employment 6000 unemployed graduate (“ITWeb-JCSE Skills Survey,” 2011).

In 2013, an assessment was conducted of the Financial Services sector in South Africa to inform future strategy in this area. The findings, published in the Financial Services Assessment Report 2014 indicated that there is a need for skills in the software development space.

The Cape IT Initiative (CITI) and the Western Cape Department of Economic Development and Tourism (the Department) have been working in partnership for several years in order to develop the supply of quality Information and Communication Technology (ICT) skills in the Western Cape. Based on the findings of the above-mentioned report, and discussions between the Department, CITI and UCT, necessary research was conducted to understand the demand of software development skills in the Western Cape.

The purpose of this study was to determine the range and level of software development skills needed in the Western Cape, South Africa. Findings of the study was intended to inform the development of a University of Cape Town (UCT) approved qualification, for commencement by 2015, based on the gaps identified in the market.

The research objectives were formulated as follows:

- Determine the range and level of software development skills needed in the Western Cape to meet industry demands
- Determine the availability of relevant software development skills in the Western Cape as per industry demand
- Identify the challenges faced by industry while recruiting software developers in the Western Cape

Based on the above-mentioned research objectives, the following research questions were formulated:

- What is the range and level of software development skills needed in the Western Cape to meet industry demands?
- To what extent are relevant software development skills available in the Western Cape as per industry demands?
What are the challenges faced by industry while recruiting software developers in the Western Cape?

The study focused on ICT, financial and retail companies employing software developers in the Western Cape for their respective IT projects.

**Literature Review**

In order to better understand this research context, the computing disciplines are first reviewed. In addition, the various job descriptions (profiles) and their corresponding requirements are detailed, setting the scene for an overview of the software development role within different environments.

**Overview of the Computing Disciplines**

All computing disciplines are often broadly referred to as Information Technology (IT). However, IT is an academic discipline of its own, alongside Information Systems (IS), Computer Science (CS), Computer Engineering (CE) and Software Engineering (SE), as recognized by the Association for Computing Machinery (ACM) and the Institute for Electrical and Electronic Engineers (IEEE) (ACM SIGITE, 2012). Table 1 provides a brief overview of each discipline.

<table>
<thead>
<tr>
<th>Computing Discipline</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Information Technology</td>
<td>IT mostly focuses on the application, deployment and configuration aspect of computing. IT focuses on meeting the needs of end users within organisations and society through the selection, creation, application, integration and administration of computing technologies (Lunt et al., 2008)</td>
</tr>
<tr>
<td>Computer Science</td>
<td>Computer scientists are usually involved in (1) designing and building software (2) developing effective ways of solving computing problems, and (3) devising innovative ways of addressing challenges in robotics, computer vision or digital forensics though the use of computers (ACM, 2008).</td>
</tr>
<tr>
<td>Information Systems</td>
<td>The IS discipline is concerned with the information that can be obtained from computer systems to enable businesses, non-profit or governmental organisations in identifying and meeting their goals. IS is also concerned with the identification of business processes that companies can implement and improve on through information technologies (ACM, 2008).</td>
</tr>
<tr>
<td>Computer Engineering</td>
<td>Computer engineering focuses on the design and construction of computer-based systems and computers in general. It relates to the study of hardware, software and the interaction and communication between them (Shackelford et al., 2005).</td>
</tr>
<tr>
<td>Software Engineering</td>
<td>SE focuses on the reliable, efficient and affordable development and maintenance of software systems. SE also focuses on organisational issues as a means of developing information systems that are appropriate to the client organisations (Shackelford et al., 2005).</td>
</tr>
</tbody>
</table>

Individuals choosing a career in computing usually have a choice between four paths as shown in Table 2. Career paths 2 and 3 are specifically in the domain of computer science. Career 4 has
spawned new majors in software engineering and information technology. Computer scientists also fill positions in Career path 1, as do graduates of software engineering, information technology, and information systems (Shackelford et al., 2005).

Table 2: Career Paths in Computing

<table>
<thead>
<tr>
<th>Career Path</th>
<th>Career Path Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Career Path 1: Designing and Building Software</td>
<td>This career path incorporates work relating to web development, interface design, security issues, mobile computing etc. This can be completed in large or small companies of all kinds.</td>
</tr>
<tr>
<td>Career Path 2: Developing effective ways of solving computing problems (e.g. storing information in databases, new approaches to security problems etc.)</td>
<td>This career path involves works related to application or development of computer science theory to identify the best solution to intense computational problems.</td>
</tr>
<tr>
<td>Career Path 3: Devising new ways to use computers</td>
<td>This career path involves research work in innovative use of application technology. Individuals following this path usually have a research position at a university or industrial research and development laboratory.</td>
</tr>
<tr>
<td>Career Path 4: Work around organisational technology infrastructure</td>
<td>This career path involves work in Planning and Managing organisational and technology infrastructure</td>
</tr>
</tbody>
</table>

One particular job description in the computing discipline is that of programmer which often is referred to as computer programmer, developer, coder or software engineer. A programmer writes, tests, debugs and maintains computer programs, the requirements of which are obtained from systems analysts. Programmers are required to design, implement and test logical structures for solving problems (or business problems) by computers. Programmers work in varied work settings (e.g. big or large firms) and also in consulting companies deployed at client sites (contractors). This study focuses on the range and skill requirements of computer programmers in the Western Cape. Computer programmers fall into Career path 1 which is serviced by all 4 computing disciplines.

**Methodology**

This section presents the methodology employed to undertake this study, given the research questions and objectives presented in the introduction. An overview of the research approach is first presented, followed by a description of the study. A brief description of how the data analysis was conducted is also provided.

**Research Approach**

The study followed a two phase approach as follows:

1. Pilot Study to identify range and level of skills demand for software development within ICT industry
2. Round 2 to confirm and identify range and level of skills demand for software development within ICT industry
**Research Phase 1**

Phase 1 of the research focused on a pilot study to obtain a preliminary understanding of the range and level of skills required pertaining to software development roles and validate the interview questions (Creswell, 2013). This pilot study was conducted between October and November 2013. At the beginning of that phase, it was important to first analyse and summarise the IT related findings gathered from the Financial Services Sector Assessment Report (Draft 1). The research instruments were then devised based on the findings drawn from this first draft of the report. The pilot study was both quantitative and qualitative in nature using surveys and interviews.

Survey data was obtained from a questionnaire distributed via SurveyMonkey. The questionnaire consisted of 30 questions grouped into six parts/sections. Some questions were measured on a Nominal scale, while others were measured on a Likert scale:

- PART 1 - Demographics
- PART 2 – Graduate Information
- PART 3 – IT Usage (Programming Languages, Development/Reporting Platforms)
- PART 4 – Skills Level Evaluation
- PART 5 – Skills Requirements
- PART 6 – Appetite for Qualification

Qualitative data was obtained from interviews conducted with IT specialists from various companies in the Western Cape. The interviews lasted approximately 1 hour. The interviews were semi-structured and the interview protocol consisted of 34 questions, grouped into six parts, similar to the survey questionnaire. The quantitative data from the pilot study was analysed descriptively and the qualitative data was analysed using thematic analysis as proposed by Braun and Clarke (2006).

**Research Phase 2**

The second phase of the research study was aimed at confirming the preliminary results. The survey questionnaire and the interview protocol were carefully updated in light of the research findings obtained from the first phase of the study. For the second phase of the study data was collected between February and March 2014.

The survey questionnaire was updated to include 50 questions regrouped into 5 sections. Some questions were measured on a Nominal scale, while others were measured on a Likert scale. The survey was also distributed using an online survey tool, SurveyMonkey. The survey analysis was mainly conducted using descriptive statistics on the items measured on the Likert scale. Some of these items were grouped together for analysis based on the sections (e.g., the section that measured the skills required for software development roles in the Western Cape); while others were grouped for analysis based on the variables measured (e.g., level of programming skills, level of business analysis skills). The descriptive tests carried out calculated the means and the means were used as basis for analysis and used to draw inferences from the data.

The interviews were semi-structured, each interview lasted approximately one hour and the interview protocol consisted of 53 questions, grouped into 3 parts as follows:

- PART 1 – Demographics
- PART 2 – Required Skills for Software Development Roles in the Western Cape
- PART 3 – Appetite for Qualification
Qualitative analysis was conducted using thematic analysis, based on the research questions specified in the introduction (Braun & Clarke, 2006). The various themes identified are described in detail in the Findings Section, including sample quotes from the respondents.

During the qualitative analysis of both Phase 1 and Phase 2, the search for key themes and patterns took place throughout the data analysis process and was iterative (Creswell, 2013).

**Sample & Respondents**

A summary of the number of respondents is provided in Table 3.

<table>
<thead>
<tr>
<th></th>
<th>Round 1</th>
<th>Round 2</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Survey Responses</td>
<td>21</td>
<td>18</td>
<td>39</td>
</tr>
<tr>
<td>ICT sector Interviewees</td>
<td>4</td>
<td>3</td>
<td>7</td>
</tr>
<tr>
<td>Financial services sector Interviewees</td>
<td>2</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>Retail sector Interviewees</td>
<td>0</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Total Interviewees</td>
<td>6</td>
<td>6</td>
<td>12</td>
</tr>
<tr>
<td>TOTAL Respondents (survey &amp; interview)</td>
<td>27</td>
<td>24</td>
<td>51</td>
</tr>
</tbody>
</table>

In Table 4, it can be seen that the majority of the responses were from the ICT industry sector, followed by the Financial and Insurance sector. In addition, the responses were from a wide range of IT-related job titles as shown in Table 5. For the interviews and survey, the sample consisted of (1) the UCT IS department’s industry contact list and (2) the contacts available on the UCT IS Department LinkedIn profile.

<table>
<thead>
<tr>
<th>Industry Sector</th>
<th>Total</th>
<th>Industry Sector</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Financial and insurance</td>
<td>7</td>
<td>ICT</td>
<td>7</td>
</tr>
<tr>
<td>Health</td>
<td>1</td>
<td>Financial Services</td>
<td>3</td>
</tr>
<tr>
<td>ICT</td>
<td>26</td>
<td>Retail</td>
<td>2</td>
</tr>
<tr>
<td>Manufacturing</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mining</td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Services</td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Grand Total</td>
<td>39</td>
<td>Grand Total</td>
<td>12</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Job title</th>
<th>Total</th>
<th>Job title</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Business Development Manager</td>
<td>2</td>
<td>Development Manager</td>
<td>2</td>
</tr>
<tr>
<td>Business Systems Manager</td>
<td>1</td>
<td>Software Engineer</td>
<td>2</td>
</tr>
<tr>
<td>Consultant</td>
<td>1</td>
<td>Senior Software Developer</td>
<td>2</td>
</tr>
<tr>
<td>CTO</td>
<td>1</td>
<td>Chief architect</td>
<td>1</td>
</tr>
<tr>
<td>Developer</td>
<td>1</td>
<td>Project Manager</td>
<td>2</td>
</tr>
<tr>
<td>Director</td>
<td>7</td>
<td>CEO</td>
<td>1</td>
</tr>
<tr>
<td>Electronic Engineer</td>
<td>1</td>
<td>CIO</td>
<td>1</td>
</tr>
<tr>
<td>General manager</td>
<td>1</td>
<td>Head of Professional Services</td>
<td>1</td>
</tr>
<tr>
<td>Manager: Implementation Engineering</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>MD</td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Personal Assistant</td>
<td>1</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Survey Responses | Job title | Total | Interviews | Job Title | Total
---|---|---|---|---|---
Product Development Manager | 1 | 1
Programme Manager | 1 | 1
Project Manager | 1 | 1
Prototype Team Lead | 1 | 1
Recruiter | 1 | 1
Senior IT strategic Manager | 1 | 1
Senior Manager | 1 | 1
Senior Manager, Mobile Development | 1 | 1
Senior software developer | 1 | 1
Software Development Manager | 1 | 1
Software Engineer | 1 | 1
Solution Architect | 1 | 1
Specialist Business Analyst | 1 | 1
Specialist: Business Improvement Management | 1 | 1
Specialist: Knowledge Management | 2 | 1
Systems Specialist | 1 | 1
Operational and Support Manager | 1 | 1
SAP Consultant | 1 | 1
Chief Information Security Officer | 1 | 1
Grand Total | 39 | 493

Findings
This section describes the results of round 1 and round 2 of the study. The results relate to the needs and challenges faced in the Western Cape. The topics discussed include, (1) Challenges faced during the recruitment process (2) Skills required for software development positions, and (3) Perceived competency software developers.

Challenges Faced During the Recruitment Process

Timeframe to fill up software development positions
The respondents reported that the recruitment process for software developers usually lasts on average 3-5 months (with some lasting as long as 12 months). For every software developer being employed, about 20 have been interviewed and were deemed inadequate. Respondents struggle to recruit software developers with the right skillset and experience. 75% of the CVs are rejected during the initial screening process and companies often fail or battle to recruit software developers even after extensive recruitment exercises lasting several months.

Between February last year and today I’ve only hired five software developers and I’ve had at least that many positions to fill. It’s taken me a year to fill five software development positions. In that time I’ve probably interviewed between twenty five and thirty software developers from Western Cape and around the country.

Various reasons have been put forward for the recruitment duration period including: candidates have poor software development skills, the number of good software developers (with the right skillset) is limited in spite of having a large pool of available developers, a shortage of the correct skillset pertaining to software developers, software developers have high salary expectations but limited skills.
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Skill levels (generally) are very poor; therefore each candidate is tasked with a simple logic test, which they mostly do poorly in.

The long recruitment periods are not only attributed to a lack of adequate skills and expertise in the relevant technologies, but also to a lack of IT-related and business-related experience required from the companies. DotNet skills were perceived to be more easily available than Java but it is nevertheless harder to find people with the right level of experience in these languages. One respondent specified that, because the courses that some software developers attend are rudimentary, they are unable to perform while working in complex projects. It thus makes it harder to find people with the right skill and level of experience. Those with the relevant skillsets are scarce and available at a very expensive price as can be seen from these statements:

So, basically what you are left with is a very small group, who are exceptionally expensive, that’s the bottom line. And you then have to be able to justify it with your business plan, to afford those people.

There is a fair amount of developers out there, but very few good one. For every 20 candidates that is interviewed who have at least 3+ years’ experience there is 1 really good developer and 5 average developers

Both the quantitative and qualitative findings demonstrate that some companies have “alliances” with tertiary institutions, which facilitate their recruitment process. In particular, these companies seem to recruit software developers from “trusted sources” in order to mitigate risks of hiring poorly skilled people. These can relate to software developers graduating from education institution with whom the companies have a strong tie because of the quality of the graduates being produced, or those that have been personally recommended to them.

Non-standardised level of experience

Respondents reported a lack of standardization across companies pertaining to software development experience level. For instance, people who claim to be intermediate or senior software developers in their CV often do not have the appropriate level of experience and expertise and do not meet the entrance requirements of companies for that level of work.

Because of the simple fact that of the twenty five people that have applied through job ads and things like that, technically I would never employ them. We’ve had people who call themselves intermediate software developers who I Computing Degrees & Careers: Computer Science wouldn’t touch with a ten foot pole. That’s just from sitting them down and doing a technical three part test which is nothing advanced and nothing out of the ordinary and they failed on that every single time

Lack of problem-solving skills and understanding of business domain

Software developers should be able to solve complex problems. Businesses come with business problems and software developers should be able to contribute to conversations around business problems and possible best solutions to these problems. However, software developers with good problem solving skills are hard to find in the Western Cape. Senior developers are more likely to have these skills but not younger ones. It was mentioned that they typically do not employ software developers solely on their technical skills as they might not be able to adequately reason through a problem.
Also the ability for problem solving, it’s a case of it’s something that’s missing in a whole bunch of the candidates that I interviewed. When I do it is pretty much the pseudo code thing. I am not asking them to be syntactically correct, I’m just asking them to reason through a specific problem and talk through the reasoning and frame how they arrive at a specific solution. Problem solving is something that is just not there. From our perspective we are growing our own, in other words the realisation that employing for technical skill is just not a good strategy. We employ for technical aptitude.

Most developers are solely focused on the technology. This challenge is also particularly relevant to firms in the financial services and retail sector or consultancy firms delivering services to these institutions. Being able to practically apply IT knowledge to solve business problems specifically related to financial environments is a crucial ability which is lacking in the Western Cape.

**Lack of expertise and experience in programming languages**

The study found that most of the software developers who claim proficiency in certain programming languages actually lack real expertise and experience. Software developers who are highly skilled and experienced in DotNet, PHP and Ruby on Rails were found to be scarce. However, Java skills were found to be even rarer. This sometimes influences companies’ choice of technology during software projects and also their outsourcing decisions.

For financial and retail institutions, given that the core of their business is not IT, they tend to hire the required expertise from software houses/vendors. Some of them also take on trainees and skill them up or allow the consulting firms to skill them up. These consulting firms can be both within and outside of South Africa.

> It takes us very long to fill positions because we get rubbish CVs. Because we get people who claim they can do things but that don’t have the experience that we need in terms of the programming languages.

> So we talk to them and we've got a list of .NET, Java and PLC code questions. We got about 25 questions and if they don’t know about 15 of them, then they don’t know the language.

**Lack of design skills focusing on user-experience**

Skills in user experience design were recognized as important but respondents mentioned that there are few software developers available in the Western Cape who are able to embark on this type of work. One respondent mentioned two companies specialising in user experience (UX) design namely Origin Interactive in Pretoria and Platinum 45 in Cape Town. UX design was described as more complex than simple Web Design and in need of more specialised skills which are not easily available in the Western Cape.

One respondent from the retail sector who agreed that software developers skilled in UX design are scarce in the Western Cape mitigated the situation by ensuring that software developers spend enough time with marketing experts. In doing so, software developers would get to understand the user needs and model their GUI accordingly.

Lack of UX skills is also relevant for respondents involved in mobile development work. It was reported that software developers lack experience in designing GUIs for mobile phones and even less for entry level phones.

> There’s no one in the market at the moment that is... Two companies that I know, Origin Interactive in Pretoria and Platinum 45 down in Cape Town who sell themselves as UX designers. There are web designers, hundreds of them in Cape Town but for me it doesn’t matter. Web design is it’s not good enough for me anymore. You use an experienced person first that you put into the shoes of the user and designs appropriately for them.
Limited capabilities in large-scale and complex real world infrastructures

The inability of software developers to leverage off existing large and complex infrastructures has been reported as a challenge. This is the case for both junior and experienced software developers (only 20% of people interviewed according to one respondent). While some of them might be proficient in some programming languages, they are unaware of how to code within a complex infrastructure to support a large pool of end users (more than 3000 users) without running the risk of system crashes and security threats. It was also reported that most software developers have limited experience with big data. Respondents deplored the fact that existing courses offered by tertiary institutions do not include such material in their syllabus.

Those with good theoretical understanding of software development principles have limited understanding of the building blocks required to build a reliable and stable application in a complex real world infrastructure (e.g. with complex network infrastructures) and which could be deployed across several continents. They are unable to look at a problem from various perspectives and develop an application solution, taking into consideration all the myriads of other systems which their application could impact or be impacted by. Software development experience in the Western Cape (and possibly South Africa) is mostly limited to simple projects and infrastructures.

What we find with candidates both inside and outside varsity is that the depth of knowledge is very shallow. Even the guys with 3-5 years of experience, they’ll be extremely strong in one specific area in development for example. They could be a coder and they would have very strong skills when it comes to coding, they have no understanding of how it ties to real world systems. And we look for that in the interviews

Lack of understanding of good software development principles and practices

The findings revealed that in the Western Cape, most software developers have a poor understanding of the principles and best-practices of software development work. This can relate to a poor understanding of software development methodologies, a poor understanding of object-oriented concepts and an inability to efficiently apply these concepts, an inability to design well-structured codes, an inability to implement good design, poor understanding of software architecture and poor understanding of good testing practices. The following quote clearly illustrates this gap:

I would be giving you a rough estimate, but I would say that 70% of the people don’t have that understanding. It’s only the top 30% of the people in the industry who understand. Maybe I just have bad luck in dealing with people. And if you think of the pool from the university, then that’s already much fewer. Some graduates only acquire these skills after having worked in the industry for a few months.

Respondents described graduates’ programming skills as “prototyping and hacking” as opposed to being carefully crafted and designed to fit enterprise level development projects. Copying, pasting and editing code until the program works has been reported as a common practice by some software developers whom they perceived as “lazy” as opposed to being “more intellectual”. On the other hand, “intellectual” software developers were sometimes prone to over-complicate things. One respondent resorted to regular code reviews to address the problem.

They do develop but in a way that we call prototyping and hacking. So when you start to develop for enterprise level development projects you are often find that there are good engineering practices that go along with it.
The lack of good software development practices is also translated in the design. Hence, they have to resort to strict screening of candidates to identify the correct ones. One respondent mentioned that only 40% of the candidates interviewed demonstrate some ability to apply design patterns. In particular, respondents reported that some software developers are unable to think logically and should be introduced to systems thinking in the long run. Some candidates to software development positions have poor understanding of layered architecture and the need for business logic and data access layer. It was perceived that some software developers are used to being given specifications and just code off that specification without questioning the relevance of the design and the value being added by their design. However, one respondent perceived that candidates with university degrees are more likely to have good design skills as they would usually have been exposed to design patterns during their degree. Overall, irrespective of whether the design is done by a software architect or a software developer, it is important that they are able to see the big picture and apply the relevant design patterns, and the number of people who can do so (knowledge & experience) is scarce.

Another respondent also noted that graduates often have poor understanding of good testing practices, including unit testing and other forms of testing. Knowledge and experience in automated testing and test-driven development was highly valued and found missing in the Western Cape. In addition, good testers are hard to find and expensive in South Africa. Good testers should be able to understand and test for the real business value of a use case.

Good programming practice, error handling is something that people can’t spell. They just don’t...everyone assumes that everything works. They don’t assume it will break, so my engineering background, because I did engineering first and then I did IS, is that you assume everything breaks first and then you make sure it breaks elegantly. I think that is another key thing is that people haven’t been taught to, critically analyse the likely things that can go wrong with a project. To find people who can do that is actually really hard, even experienced developers.

Figure 1: Challenges faced during the recruitment process
To mitigate the problem, some companies send their software developers on training courses. These courses serve as a platform to teach them the principles of software development (e.g. why do we test, importance of specific tests, release planning etc.). They also have yearly refresher courses on systems design (e.g. database design) as it was perceived that people keep forgetting. According to one respondent from the retail sector, junior and inexperienced software developers are usually the ones to be sent on these courses.

A summary of the challenges faced is provided in Figure 1.

**Range and Level of Skills for Software Developers**

This section describes the range and levels of skills required for software development positions in the Western Cape. Table 6 shows the software development platforms, programming languages, mobile development platforms and reporting tools employed by the respondents and provides an indication of the type of software development skillset required in the Western Cape.

From the responses, the majority of the respondents assert that their IT project teams work on windows based development, database development and mobile development platforms but do not use Mac development platforms. Other platforms mentioned include: ERP Packages (SAP), AS/400 RPG, Java (J2SE), IBM, Linux based PHP and Oracle ODI.

The most popular programming languages include Java, C# and Javascript in contrast to Visual Basic.NET, PHP and COBOL. Other programming languages mentioned include Advanced HTML/CSS for responsive design, Python, ABAP, RPG and NoSQL.

For Mobile Development the platform development environments that the IT project teams currently focus on include Android and iOS SDK. One of the respondents suggested that they would “rather target HTML5 capable to make the solution more platform agnostic”.

Crystal Reports and SQL server were the more popular reporting tools being used by the IT project team(s). Other tools mentioned are: ERP BI, SAP Business Objects, Micro Strategy, and DevExpress Reports.

Finally, the majority of the respondents claimed that software developers are proficient in Object-Oriented Programming Languages and Scripting Languages rather than Functional Programming Languages.

**Table 6: Usage of Platforms, Languages and Tools**

<table>
<thead>
<tr>
<th>Software Development Platform</th>
<th>% usage</th>
<th>Responses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Windows Based development (.NET)</td>
<td>40%</td>
<td>35</td>
</tr>
<tr>
<td>Mac development</td>
<td>3%</td>
<td>35</td>
</tr>
<tr>
<td>Database Development (MS SQL Server, My SQL, Oracle etc.)</td>
<td>51%</td>
<td>35</td>
</tr>
<tr>
<td>Mobile Development</td>
<td>31%</td>
<td>35</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Programming Languages</th>
<th>% usage</th>
<th>Responses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Java</td>
<td>34%</td>
<td>35</td>
</tr>
<tr>
<td>C#</td>
<td>34%</td>
<td>35</td>
</tr>
<tr>
<td>PHP</td>
<td>20%</td>
<td>35</td>
</tr>
<tr>
<td>Visual Basic.NET</td>
<td>17%</td>
<td>35</td>
</tr>
<tr>
<td>Javascript</td>
<td>46%</td>
<td>35</td>
</tr>
<tr>
<td>COBOL</td>
<td>9%</td>
<td>35</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Platform for Mobile Development</th>
<th>% usage</th>
<th>Responses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Android</td>
<td>31%</td>
<td>35</td>
</tr>
<tr>
<td>Blackberry</td>
<td>14%</td>
<td>35</td>
</tr>
</tbody>
</table>
Table 7 shows the results of the quantitative tests analysing respondents’ perceptions of the level of expertise of software developers in specific programming languages and their availability in the Western Cape. Generally the level of expertise in scripting, object oriented and functional languages is below average and needs improvement. Object oriented languages appear to require the most improvement. The respondents perceived that the level of expertise of software developers in the specified programming languages is between average and good. The lowest expertise appears to be in C#. The availability of skills is below requirement in all language types and languages with the exception of VB.NET. In terms of availability object oriented languages are the least available and especially C#.

Table 7: Level of Expertise of Software Developers in Specific Programming Languages and their Availability in the Western Cape

<table>
<thead>
<tr>
<th></th>
<th>Level of Expertise (3=average; 5=excellent)</th>
<th>Availability of Proficiency (3=meets requirement; 5=far above requirements)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Object Oriented Languages</td>
<td>2.5</td>
<td>2.2</td>
</tr>
<tr>
<td>Functional Programming Languages</td>
<td>2.8</td>
<td>2.3</td>
</tr>
<tr>
<td>Scripting Languages</td>
<td>2.7</td>
<td>2.4</td>
</tr>
<tr>
<td>Java</td>
<td>3.4</td>
<td>2.4</td>
</tr>
<tr>
<td>C#</td>
<td>3.1</td>
<td>2.3</td>
</tr>
<tr>
<td>PHP</td>
<td>3.5</td>
<td>2.6</td>
</tr>
<tr>
<td>VB.NET</td>
<td>3.6</td>
<td>3.3</td>
</tr>
<tr>
<td>Javascript</td>
<td>3.4</td>
<td>2.5</td>
</tr>
<tr>
<td>COBOL</td>
<td>3.3</td>
<td>2.3</td>
</tr>
<tr>
<td>Other software development languages</td>
<td>3.8</td>
<td>2.3</td>
</tr>
</tbody>
</table>

Based on the qualitative findings, an ideal candidate for a software development position should have some expertise in both functional and OO programming. The respondents mentioned that they look for evidence of proficiency in the programming languages employed within their company. The candidate’s level of qualification is not as relevant as the expertise, proficiency and experience in the language and technology. They thus dedicate a proportion of their recruitment...
Software Development Skills Needed in the Western

process to the assessment of candidates’ degree of expertise and flair for relevant programming languages and technologies.

For software development positions, they favour candidates with more exposure to software development by the time they get out of university, which they feel is more the case of computer science students. Information systems students follow a business analysis career path in some organisations. However, some organisations believe that programming languages are easily taught, provided that the software developer has a good theoretical understanding of the concepts and a strong technical aptitude.

Senior software developers are expected to have a deep understanding of relevant programming languages and technologies, given their experience. They are also expected to have good understanding of best-practices and standards pertaining to software development work, irrespective of whether these standards are embedded in the programming language being used or not. However, given that the range of technologies available on the market is currently quite vast, respondents found it difficult to find software developers with 3-5 years of experience in specific technologies. They perceived that software developers engage and migrate from one technology to the next.

Financial institutions reported that, in addition to experience and expertise in the programming languages and technologies, experience on trading systems and financial accounting systems would be a plus.

For programmers themselves the most important thing is that we can see evidence that they are proficient in one of the languages that we use.

In terms of more senior people, we look for obviously years of experience in specific technologies. Now again those specific technologies today are so vast and wide that to find somebody with three to five years in a specific technology is hard because people are doing all kinds of different things.

Qualifications for software development roles

While most companies recruit at Bachelor’s or Honours level, the level of qualification required from the applicants varies depending on the nature of the work being performed within the company. For less complex and smaller scale projects, qualifications from universities of technology are deemed sufficient. For larger scale projects, undergraduate and honours university degrees are favoured. Candidates with university degrees are usually found to be more versatile with a wider range of skills (e.g., project management, software design, software analysis, problem solving skills) in addition to development work.

Generally here at XXX we do look for people with a university degree. As an institution, we feel that it is easier to take a person with a university degree and be able to move them around within the business because they have a better understanding of the principles behind these things. Again it depends. Some guys don’t even have degrees. They are auto dialect and they teach themselves, we’re happy to take them as long as they show that they’re bright. We’ve got our own psychometric test that we perform and there is a general face to face interview. But the majority of people that do work here have got degrees.

Respondents further noted that they seek intelligent software developers with a desire to learn and identify gaps in their knowledge, who are patient and with a strong will to acquire new technical skills to solve software problems. Respondents usually associate the dedication and perseverance required to solve programming problems with university graduates, who in their opinion would
have spent many “all-nighters” trying to learn and devise new algorithms to solve particular business problems (special reference made to the IS project at Honours level).

A lot of self-aptitude and desire to learn. So I need to have them demonstrating that I learnt this cool thing and I pursued it and I learnt how to do it. These are indicators that they have that. The other aptitude is patience where someone needs to know that they won’t know it initially. They will slowly start attacking what they don’t know.

Skills pertaining to mobile development

The respondents were ambivalent pertaining to the need for mobile development skills in their teams. Some of them mentioned that the mobile space is too much in a state of flux to invest in; others specified that they would rather go for the “responsive design” option, as opposed to native development. Responsive design was favoured as it was perceived to yield a higher return on investment. Native development work is typically outsourced (locally) to expert vendors. Respondents did not seem particularly interested in hiring software developers with mobile development expertise, but rather sought to train their existing staff in that space.

I’ve done a bit of research and it seems that the easiest way to solve those problems is to outsource it. There seems to be a huge number of companies that are able to do it and until things stabilise in terms of the trend and the software development environment, in terms of the tools

Everything we are developing is mobile responsive design. So that’s the extent to which we are doing mobile at the moment. I’m not saying that we are not going to be making a play into the mobile native space moving forward but right now our requirements are mobile responsive design. It’s working out for us on a return of investment perspective, it’s our best return.

Respondents did not seem particularly interested in hiring software developers with mobile development expertise, but rather sought to train their existing staff in that space. They rationalise their decision from the notion that there is not enough demand, in the corporate world, for pure mobile development work. A mix of skills, as opposed to pure mobile development expertise, was found more important. Mobile development was perceived as relatively easy in comparison to building server-type applications which, in their opinion, require more complex skills.

In the financial service sector, the two respondents interviewed were of the opinion that mobile application development will be gaining more momentum. However, they acknowledged the fact that it is currently difficult to choose what to teach to students, given the myriads of mobile development platforms available on the market (e.g. Microsoft Mobile development, Apple, Android, Blackberry platforms etc.). They suggest that it might be more relevant to reflect on the toolset that a mobile developer should have and incorporate that in the curriculum, rather than focusing on the technology. They reported that they currently have no capacity to support mobile development work within their organisation.

Analysis skills

The majority of respondents recognized that software developers should have some understanding of business analysis (BA) and systems analysis (SA). Most respondents specified that even though there is no need for software developers to have in-depth skills in business and systems analysis, they should at least be able to look at a system and identify areas in need of improvement and propose solutions.

Software developers should understand the domain and be able to contribute to analysis given the fact that software programs are meant to solve real world problems. They believed that a
Software Development Skills Needed in the Western

programmer would only be able to understand real world problems with good business and systems analysis, as well as logical skills. A software developer is expected to engage with customers and help business analysts design better solutions. This is particularly important in an agile work environment. The programming language was perceived as a tool through which the problem can be solved. They also perceived that any talented programmer would not be able to deliver real business value without an understanding of the domain. They reported that they would not hire a programmer (no matter how good) who does not have some business analysis skill and who is not able to understand the domain.

The need for software developers with good business knowledge as well as technology knowledge was also highly relevant to respondents from financial and retail institutions, as the software developers are required to support existing applications in complex environments with multiple platforms and technologies. For instance, one respondent from the retail sector specified that candidates with business knowledge and experience in the retail field are hard to find. For financial institutions, given that the industry is governed by regulatory controls in terms of reporting and taxes, they often receive change requests pertaining to new legislations. They thus require software developers with the ability to interpret the changes, look at the domain and understand the impact of the changes for the application, the processes and the business.

My opinion is that a developer should understand the domain and should be able to contribute to analysis. My reasoning is that again it goes down to the principles because a program is meant to solve a real world problem. And so, often it is your action or your own logical meta-model that creates the program not the programming language.

**Design skills**

Most of the respondents reported that it is crucial for software developers to perform good design. In companies where new projects are regularly initiated, good design expertise is a prerequisite and candidates are probed on their design skills during the interviews. For example, they should be able to consider the impact of their design solutions on the overall ecosystem. They should be aware of certain risks and the impact of systems crashes on the entire environment and this requires a high degree of expertise in systems design. They should be aware of issues around efficiency, performance and usability while designing the middle tier in addition to being appealing at the front-tier. However it was reported that only 20-30% of job candidates in the top pool (30% of applicants with relevant CVs) are proficient in software design.

The ability of software developers to perform good design is also relevant when software development work is being outsourced by financial institutions. These organisations have mentioned the need to conduct architectural and software design themselves, in order to retain the design and architectural knowledge in-house.

Design pertaining to internal code structuring was also noted as important. For instance, it was mentioned that during the interview process, they do look at the code written by the candidates to see whether the program has been modularised or not. It was recognised that software developers are expected to design a complete solution and think it through from beginning to end without relying on tools to generate codes.

When a developer comes in, he won’t be working on the customer system but on the other system that runs it or supports it. So if you’re busy with a system that runs NetFlick’s website for example, you’ll need that understanding and experience that tells you that the work you’re doing here is going to tie in to the database server that other teams work on. They need to think, why would I do things like this and not like that? If I built my application with the database on the one side and the application server and everything on the one server, the risk is that if something goes wrong, the entire environment falls over. So that’s normally experience you
gain from working in the industry. But it is also something that can be taught if you give somebody access to these environments.

A summary of the range and level of software development skills is provided in Figure 2.

![Range and Level of Skills](image)

**Figure 2: Range and Level of Software Development Skills**

**Summary of Challenges Faced During Recruitment of Software Developers**

The challenges faced during the recruitment of software developers in the Western Cape relate to:

- Long and expensive recruitment process because of unavailability of relevant skillsets in the market
- Lack of standardization across companies pertaining to software development experience level
- Lack of problem-solving and business analysis skills from software developers
- Most of the software developers who claim proficiency in certain programming languages actually lack real expertise and experience
- Software developers with enough expertise and experience in User Experience (UX) design were found to be important but rare in the Western Cape
- Software developers are unable to leverage off large and complex infrastructures, in spite of being sometimes proficient in programming languages
- Most software developers have a poor understanding of the principles and best-practices of software development work

**Summary of Range and Level of Software Development Skills**

A summary of the range and level of software development skills needed in the Western Cape, South Africa is provided below.

- High proficiency in a wide range of functional and programming languages including Java, PHP, DotNet, C#, ASP.net, PLC Code (Oracle Programming), SAP ABAP, Pascal, Javascript and Ruby on Rails.
- While most companies recruit at Bachelor’s or Honours level, the level of qualification required from the applicants varies depending on the nature of the work being performed within the company.
- Software developers are required to have good problem solving and business analysis skills in addition to technical expertise.
- Software developers (especially senior software developers) are required to have an understanding of software development principles. These include an understanding and expertise in software design patterns, architectural design and software development best practices.
- Respondents reported that it is crucial for software developers to perform good design, particularly in instances where new projects are regularly initiated. Software developers are expected to design, taking into consideration the overall ecosystem, risks, efficiency, performance and usability issues amongst other.
- Respondents did not seem particularly interested in hiring software developers with mobile development expertise, but rather sought to train their existing staff in that space. The respondents were ambivalent pertaining to the need for mobile development skills in their teams. Some of them mentioned that the mobile space is too much in a state of flux to invest in.

Conclusion

The findings of this study confirm that software development skills are sorely needed in the Western Cape, South Africa. Software developers with certain skill sets are required and in most cases these skills need development and are not available in terms of recruitment.

Overall, it appears that candidates with a good ability to adapt to new technologies, understand business domain and with a good attitude towards work are prized by recruiters and in great demand in the Western Cape.

Given the gaps identified in the market, it is proposed that tertiary institutions should seek to address the lack of relevant software development skills in the Western Cape. A curriculum would have to be carefully crafted to meet the exact needs of industry.

References


Biographies

Dr Maureen Tanner has been teaching systems analysis and design at the Department of Information Systems of the University of Cape Town since 2009. Through her teaching, Dr Tanner strives to inculcate thinking, analytical and problem solving skills to her students. Her courses are also geared towards business analysis, from both theoretical and practical perspectives. Her research interests lie in Agile software development related issues (for both collocated and distributed teams), UML, software engineering and social aspects of social engineering, global software development, virtual teams, and team collaboration.

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Abstract

We explore the idea of a society where learning has become second nature to us and we are self-motivated to continuously expand our own knowledge and to improve our own skills.

Online learning, both m(mobile) and e-learning, is removing the barriers of entry to lifelong learning, by combining the three main streams of learning: formal, non-formal and informal learning, it has become part of our daily lives.

An important barrier that still remains is psychological. There is a perception that only formal learning done in schools and institutes of higher education is meritorious. Formal education is revered, as it should be, and we receive recognition for this type of learning in the form of certificates, diplomas and degrees. It improves our station and status in life but it comes at a cost. The cost in time, money and energy is high so we try to complete our studies as soon as possible and continue on with our lives. This model has served us well up until now, but with the rapid pace of technological change we need to keep upgrading our “brainware” and therefore we need a parallel system that is less formal but can still improve our lives. With an estimated 200 million people unemployed globally, learning is not a luxury anymore but a basic need. Of particular concern is the high youth unemployment and the increase of the average global life expectancy.

We need a new approach to improve the recognition and acceptance of all types of learning thus providing practical value to the learner. The concept of the University of L.I.F.E, where L.I.F.E stands for Learning, Innovation, Finance and Exploration, aims to do just that.

Lifelong learning can lead to innovation but new innovations needs to be financed. Once financed it can become a business but that business needs to grow and hence further opportunities needs to be explored, which brings us back to learning again.

This paper puts forward a model to seamlessly integrate: learning, innovation, finance and exploration into an individual's life.

Keywords: formal education, non-formal learning, informal learning, online learning, m-learning, e-learning innovation, finance and exploration.

Introduction

Traditionally we used three forms of education and learning: formal, informal and non-formal.

The Organisation for Economic Co-operation and Development (OECD) gives the following definitions for each
(“Recognition of non-formal and informal learning,” n.d.):

**Formal learning**: is always organized and structured, and has learning objectives. From the learner’s standpoint, it is always intentional: i.e. the learner’s explicit objective is to gain knowledge, skills and/or competences.

**Informal learning**: is never organized, has no set objective in terms of learning outcomes and is never intentional from the learner’s standpoint. Often it is referred to as learning by experience or just as experience.

**Non-formal learning**: is rather organized and can have learning objectives.

Online education is a combination of all three forms of learning. Massive Open Online Courses or MOOC’s covers formal education, learning from other peoples mistakes or success stories, interviews with successful business leaders for example, can be seen as informal learning and tutorials and “How-to” videos can be seen as non-formal learning.

In today’s fast changing and ever increasingly connected world we are relying more and more on the online stream to keep us up to date with new innovations and technology. The formal education sector is by its nature and design not always able to keep up with this rapidly changing world or with disruptive technology (Senser, 2012). Being “professional students” is not something most people can afford, or have the time for, and teaching someone about something that is not even invented yet is obviously impossible. Even if formal education can keep up and sometimes lead innovation it will still be required that all graduates go back for further study at least every two to three years and hence non- and informal learning has become essential.

The Organisation for Economic Co-operation and Development (OECD) and others are currently developing policies for the recognition of non-formal and informal learning to integrate with, and support formal learning. In South Africa SAQA (South African Qualifications Authority) in conjunction with various other stakeholders defines recognition of prior learning or RPL (SAQA RPL, 2013).

**Lifelong Learning**

We’ll start with some quotes from W. Edwards Deming (n.d.):

“One is born with intrinsic motivation, self-esteem, dignity, co-operation, curiosity, a yearning for learning, these attributes are high at the beginning of life but are gradually crushed out, diminished, year by year, throughout life. Why crush them out, why not nurture them?”

“Learning is not compulsory.... neither is survival.”

“Two basic rules of life are: 1. Change is inevitable. 2. Everyone resists change.”

We learn something new every day. Without learning and adapting to changes around us we will not survive, it is the most natural and essential thing we do and yet we have managed to disconnect ourselves from learning. We make learning out to be this difficult thing that we have to suffer through and pay a lot of money for. This erroneous perception is the route cause of many of the problems in modern society. It has caused a “mental block” to learning and feelings of inferiority in many, even in highly educated people.

We did not have to go to school to learn how to walk and talk. Walking on two legs and talking, communicating our needs to others, are some of the most complex things we'll have to learn and yet it happens quite naturally, and for free, in the first 3-5 years of our existence.

Informally we learn from a variety of sources: family, friends, TV, books, co-workers, games (real and virtual), Google, YouTube, experimenting, failing, talking to others, Facebook, Twitter,
etc. Most of this learning is quite effortless and easy but that does not mean that it is not important or essential to our well-being. The only difference between formal and in/non-formal learning is that most people do not see the latter as valuable. There is no system for evaluating the relevance of these forms of learning which makes it harder to define and value, unlike the accreditation system for formal learning which can be “officially” recognized.

We complicate things way too much.

So what will happen if we incorporate formal “higher” learning into our daily lives as naturally as we do informal learning? We need an alternative way to present formal learning and to change the perceptions associated with it. We could present it more in the form of a film or series and make it much more interesting through the use of animation, music and interviews with different people compared to the traditional one lecturer “talk-and-chalk” approach. “Stories are the enactment of the whole mind in concert with itself” (Fisher, 1984).

All forms of learning should be part of our culture and our normal life and in so doing we will nurture and not crush our natural yearning for learning.

Let's explore the possible ways that this can be achieved.

**Learning in a relaxed informal environment**

Creating an informal and relaxed physical environment where people of all walks of life can meet and learn from each other is advocated. “Educational studies provide a strong argument for the importance of learning in informal settings” (“Informal learning settings.” n.d.). This is not a new idea and has been around since antiquity, take sitting around the campfire and sharing stories as an example.

The coffee shop is a more modern example. First established in the Ottoman Empire in 1555 and later in Europe in 1645 it was a place to discuss politics, debate, get the news and learn from each other (Ellis, 2011). The Knowledge Café (Gurteen, n.d.) is the most recent variation on the theme.

Many people working online today are using coffee shops as their office because of one very important technological development, access to the internet via Wi-Fi. People are telling us how they want to work, so let them study and learn in an environment where they are comfortable as well.

An informal virtual space is as important and Web 2.0 with social media provides this environment. “A Personal Learning Environment or PLE is a potentially promising pedagogical approach for both integrating formal and informal learning using social media and supporting student self-regulated learning” (Dabbagh & Kitsantas, 2011).

Why would you go to a coffee shop if you can work in the comfort of your own home? The answer will be explored in the next section.

**Social interaction**

We are social creatures and need to feel part of society. In the “real” world fear of rejection stops us from interacting with most random strangers. This fear could be overcome if we create a relaxed environment which is purposefully designed to encourage people to interact with each other.

This is the reason why the formal educational facilities will survive into the future. We can talk to fellow students; we are all there for a common goal so it makes it easier to meet new people either by being in the same class, studying the same subject, sharing the cafeteria or just sitting under the same tree on campus grounds.
We can use virtual or social networks and chat rooms and forums and Skype but at the end of the
day nothing quite beats looking someone in the eye and having a long in-depth conversation with
them.

If we want to integrate the virtual and the real worlds for a more holistic learning experience, and
make this available to all people, we need to create this physical common purpose environment in
places other than educational institutes and make it readily accessible to the general public.

**Social learning**

One of the most practical and efficient ways to keep up with our changing world, and to continue
learning, is to use the online resources available on the internet.

The problem with individual studying is that it can be confusing, lonely and extremely daunting if
faced with the mountains of information that is out there today. Personal social contact remains
important and meeting face to face first, will enhance the use of technology afterwards (McDermott,
1999).

The learning experience can be greatly enhanced by forming small study groups of 3-5 people
that have similar interests. The group can support each other, share information and ideas, work
on new innovations, and start joint business ventures.

The two most pressing issues facing us today is the level of youth unemployment and the aging
population. Bringing people from across the generations together will combine the daring of
youth and the wisdom of the more mature to learn from each other and to mentor each other.

“Knowledge flows through professional communities, from one generation to the next” but also
in social communities. “To develop knowledge develop communities” (McDermott, 1999).

Knowledge is information **and** thinking, Sharing and discussing ideas about the information will
expand the knowledge of all.

Learning for the sake of learning feels like a waste of time. Although this statement is not true at
all, we as humans do need some incentive in the form of: a qualification, an increase of salary,
increase of social status, or just a better life to show as reward for our efforts. If one day we can
break the pre-conceptions that go with learning, this will change and it will just become part of
who and what we are, continuously learning creatures, and we will not need any external affirmations. The aim of lifelong learning is to enhance one's life and not just to get recognition for what
was learned. Being able to apply your learning in your own life and thereby improving it, is the
ultimate goal.

**E-learning**

There is wealth of knowledge online, which covers almost all topics. Everything from top univer-
sities offering Massive Open Online Courses or MOOC's to simple user demo's on YouTube or
blogs and user forums, digital books, user manuals, and step by step tutorials is all online. More
information than we can learn in a thousand lifetimes.

**Portfolio of evidence (PoE)**

Individuals have a wide range of interests and learning will therefore be multidisciplinary and
interdisciplinary. This is where the challenge lies.

For example, Mary went online and learned how to boil an egg but also studied the chemical
changes that happen and tried explaining it using quantum theory, she also looked at the envi-
ronmental impact of an egg and the economic impact of small chicken farmers. Not to mention
the genetic modification of the feed and the conspiracy theory behind that. She now keeps her
own free-range chickens monitoring their health using wearable technology which feed into a database on a cloud which she helps to analyze. She also controls their coop with automated climate control run from an app on her iPad. She uses the latest nano-fiber egg-catching nets which she developed in collaboration with a leading university on the other side of the world and got crowd funded in a day.

She might be the leading authority on eggs but she only has formal Grade 6 education because her country is still at war after 20 years.... How do we accredit that and what qualification do we give her?

She wants to emigrate but her country of choice does not have “egg-expert” listed as a scarce skill and she is denied entry. She applies for a lecturing post at a university but can't be employed because she does not have a PhD, ditto with the big corporate who wants an MBA so she is stuck and could spend the rest of her life in abject poverty because her coop got bombed and she lost everything except her cellphone which she uses to make a movie about her life and puts it on YouTube which goes viral and now she tours the world giving talks at universities and big corporations and runs her own multi-billion dollar company.

Moral of the story- be a content creator not just a content user.

The portfolio of evidence can consist of a mind-map which can be used as a Digital Curriculum Vitae (DCV) or as PoE for recognition of prior learning (RPL), starting with the individual and listing all her/his interests or fields of study. This can then be broken down further into credits, qualifications, papers, blog articles or preferably into short movies explaining what was learned. The ubiquity of cell phones with cameras and microphones and free open source video editing software (List of video editing software, n.d.) makes creating your own movies relatively easy.

My suggestion is to blog or Tweet or even a Facebook update about what was learned daily (public declaration should incentivize self and others) (Dalsgaard, 2006), make a 5 minute movie once a week summarizing and detailing what was learned and then compile that into a short film at the end of studying a particular subject and posting that to YouTube or a similar site. This could turn out to be a career for a gifted communicator. Telling the story of your own learning fits in with the idea of homo narrans where the current rational world paradigm becomes a subset of a larger narrative paradigm. (Fisher, 1984)

If the PoE ties in with a progress report (http://www.khanacademy.org/) or good Learning Management System (LMS) (https://moodle.org/ and others) the new potential employer can have an in-depth overview of the work-applicants field of study. An institute that accredits Recognition of Prior Learning (RPL) will also have a complete Portfolio of Evidence to work from. And the learner will be completely amazed at the amount of knowledge they gained in a year.

Understandably this will take a lot of discipline in the beginning and a big change in mindset but I do believe that once people see the benefit and start gaining self-confidence that it would be something that they will start looking forward to doing. If only a few people can improve their self-esteem and embrace learning daily, no matter what their circumstances, current educational level or income level, we could see a big change in the world. The individual's world would certainly change and it would give them hope for the future.

**Innovation**

The more we learn about different subjects, the greater the chance to integrate various aspects of these subjects into a single solution, resulting in a new innovative approach to a problem. Similarly, a diverse group of people studying one topic together, each with a different knowledge base, skill-set and background, has an even greater potential to discover an unique solution.
The rate at which technology is moving and all the new tools that come online daily makes innovation even easier. Computer modeling, crowd sourcing and 3D printing can be of great benefit to the learners helping them to test new ideas and to solve problems much faster.

Innovation Incubators assumes learning to be in place already and provides additional support to members, whilst the Maker Hubs/shops (Cavalcanti, 2013) have more of a learning element to them but both of these models can be easily integrated into the learning environment.

**Finance**

Financing for individuals or small groups still remains a problem if you are not connected in the right networks.

We have a lot of options: micro-financing, crowd funding, angel investors, venture capital, banks, grants, competitions etc.

The option that we would like to explore is micro-franchising and angel investors.

If the Angel Investor is part of the original study group s/he can get to know the people, assess their learning and critical thinking ability, work and learn with them and thoroughly problem solve an innovation before he invest his money. If the investor does not want to be personally involved s/he can also anonymously sponsor a field of study and pick the best teams to work with or purpose build a team from the study groups.

Study groups with low income can also look at starting a co-operative or a micro-franchise. Examples of this will be ice-cream sellers on bicycles, the Coca-Cola distribution networks, etc. (Conde, 2013)

Another example will be to implement the ideas in this paper and let's say we call it L.I.F.E centers and we are starting with no or very little money and hence cannot afford premises or the IT infrastructure needed. We can approach an existing coffee shop, maybe one that is a bit quiet and needs some more customers. They have the space, the atmosphere and most of them the Wi-Fi. We can partner with them and start with one or two groups and grow it from there until we are able to afford our own place.

We could start a group in a normal family house if they have ADSL and Wi-Fi. We are assuming that the groups will have at least one smart phone or tablet amongst them or we can loan/rent them one.

In rural areas where there is no or limited infrastructure we can use mobile vans or busses or use shipping containers, install solar panels and broadband access (satellite in extreme cases) and have a small internet cafe and charging station. Obviously this will take some investment but we could get that sponsored or work with one of the cellular companies because it will be beneficial to them as well.

Through this we can build up a network of small operators as franchisees and provide them with the branding and technological support, negotiate better rates for data and devices and do national marketing and promotion.

Even if we look at a mostly free service for the learning provision part of this, the small operators can still make money indirectly by selling food and drinks, offer battery charging or rental services, or charge a small membership fee.

There is also a growth path open to them in the form of accredited testing and practical centers. As the business grows they could offer these services to offshore or non-local universities if they have adequate facilities.
For universities and other educational institutions providing their online course content for free, these centers can provide a source of income because they facilitate the assessment and accreditation provided by the universities, benefitting from economy of scale these fees can be kept small and be split with the franchisee making the courses profitable.

With the backing of larger corporations, NGO's and Governments and with enough funding this can be scaled and bring employment and education to almost everyone on this planet.

**Exploration**

Once the learning and the innovation is in place, companies or partnerships are formed and financed and they grow to be successful, constant exploration into new ideas and business models will follow.

Exploring new ways to deliver content and increasing our collaboration will provide new models of learning. By eliminating the fear and competition that is now associated with formal learning we will regain our intrinsic motivation to learn. Our dignity and self-esteem will be restored because we won't feel judged and condemned but supported in our quest for self-enhancement and self-discovery. We will be encouraged to fail and to learn from the mistakes as to enable deep learning and fuel our curiosity. We will not be focused on short term outcomes and results but on living a rich meaningful life.

Who knows where this exploration will take us..... nanotechnology that deliver information straight into the brain, direct connection with artificial intelligence (AI) and an integration with other technologies as we approach Singularity (“Technological singularity,” n.d.)

One day we might even truly understand the Unified Field Theory and realize that we are always and in all ways connected to everything in the Universe and that we can tap into that infinite knowledge at will (Hagelin, 2011).

We have not scratched the surface of the world's biggest unexplored and untapped resource, the human mind. Imagine what can be achieved using this resource by itself, all 7.2 billion of us (World Population, 2014) and now add in the power of super computers, the web of things, bio- and nano tech, AI and most importantly of all, the human spirit and soul..... “to infinity.... and beyond” as Buzz Lightyear would say.

**Conclusion**

To seamlessly integrate learning, innovation, finance and exploration will not be easy but it could be achieved if we were to combine all of the above in a L.I.F.E center that has facilitators to assist the lifelong learners in their endeavours. The way forward would be to start a pilot program so that we can learn from our mistakes, explore various options, innovate and of course find a sustainable financial model for it.

The short term challenge will be to develop a generally excepted format for a Digital CV. The long term challenge will be to get buy-in from all stakeholders and establish DCV's as a viable alternative to formal education or to incorporate it into formal education.

All big changes start with small steps and this shift can be achieved if ordinary people start to live to learn. We can rid ourselves of our preconceived ideas about learning and education. If we embrace learning as part of who and what we are, we will discover that it is as important to us as eating, breathing and sleeping and that it is essential for our survival both as individuals and as a species.

“Some people believe that intellectual ability is purely genetic or fixed.
This is a myth. Research now shows that your brain is like a muscle; the more you apply it and struggle, the more it grows. People who learn to recognize this fact about their own brain develop a ‘growth mindset’ and are able to persevere and achieve more.

Imagine what the world would look like if everyone knew what they were capable of and had the mindset to learn anything.” (Khan, 2014)

Reference


Biography

Ari Terblanche is a freelance sound engineer and lecturer, runs his own company ACLA-Pro Audio and developed the Sound Engineering Diploma course for CityVarsity as well as short courses and modules for other institutions.
The Living Lab Model of ICT for Development (ICT4D) for Effective Engagement of ICT in Rural Education

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Abstract

This paper is derived from the research which was undertaken to explore the potential and reality of the Living Lab model of Information and Communication Technology for Development (ICT4D) in the rural development context (Mosuoe, 2013). The research explored the case of the Siyakhula Living Lab (SLL), a multi-stakeholder ICT4D project in the Mbashe Municipality of the Eastern Cape province of South Africa. The paper first introduces the problem that led to the exploration of the subject. It then goes further to briefly discuss the state of education in South Africa, as the case in point, then the role of ICT in education, which has the potential to address some of the challenges in education. Also to be discussed are some of the challenges related to the engagement of ICT, particularly in rural areas, which leads to a discussion of the Living Lab approach as an alternative model that can be employed, in order to address these challenges. The paper finally takes into account the case of the SLL, as an example of the initiatives that engage this model, and a case study adopted in the research from which this paper is derived. It is revealed that through the engagement of this model, ICT can be integrated in an effective manner, and can benefit learners even in rural areas. The shortcomings of the SLL are also discussed. Lastly, the investigative methods that were adopted in this research are discussed before the conclusion.

Key words: Living Labs, ICT4D, Education, rural communities

Introduction

Education in rural areas, particularly in developing countries, is often compromised by a number of factors including the lack of infrastructure, learning materials, teachers and technology, to mention a few. In the context of the information society, the new challenge is the declining relevance of rural education for the progressively ‘digital’ work environment. While children in urban and mostly private schools are learning new ways of searching and synthesising information through new technologies, which ultimately improves their creativity and inventiveness, children in rural schools remain dependent on printed materials which in most cases are inadequate. The problem of rural education, therefore,
stems from the fact that these disadvantaged children from marginalised areas do not learn how to initiate information searching and analysing towards gaining knowledge.

Although the field of ICT4D in recent years has been attempting to find ways of engaging ICT even in rural areas, access to and the sustainability of ICT in rural, marginalised areas remain significant challenges. There is a lot of literature on ICT and its role in education (Hawkins, 2002; Karthikeyan, 2013; Nkenlifack et al., 2011; Tinio, 2003); therefore, this paper will not focus much on the role or contribution of ICT in education. The literature on ICT4D reveals that when such technology is introduced and integrated, the manner in which it is integrated is often too costly and highly unsustainable (Carnoy, 2004; Heeks, 2002; Pelgrum, 2001; Pelgrum & Law, 2003). This paper, therefore, discusses a collaborative model of ICT4D – the Living Lab model – and its potential in enabling effective, sustainable engagement of ICT in rural areas. It will then show how schools in rural areas can benefit from the programmes that adopt this model. The paper will take into account the case of the SLL as an example of the initiatives that engage this model. It will show how the collaboration of the four main sectors of society: government, communities, the private sector and academia, can go a long way toward addressing some of the shortcomings of ICT in rural areas. The barriers to use of ICT in rural areas will be briefly discussed later in this paper.

The State of Education in South Africa

Education is one of the key priorities that has been set by the government of South Africa. The government has established and put in place significant documents that mandate it to ensure accessibility of education to all eligible citizens. Among these documents are the Constitution as well as the 1996 Bill of Rights. Additionally, the government has subscribed to the United Nations millennium development goals, one of which proposes that governments should achieve universal primary education, as an expression of its commitment to education. This commitment has been accompanied by quantifiable results. The UNDP’s 2013 report on South Africa reflects that by 2010, the country had achieved its goal of achieving universal primary education, even before the targeted year which is 2015 (UNDP, 2013, p. 37). The report further shows that high rates of enrolment and retention characterise the country’s educational status at the primary level (ibid.). Enrolment and retention rates hover on 98% and 96% respectively, an increase from 96% and 89.6% respectively in 2002 (UNDP, 2013, p. 28).

While these statistics are reflective of the progress that has been made by the government and citizens, the quality of education that has been made accessible remains questionable. This is especially the case in rural areas, where the quality of education is inhibited by multiple factors. The government’s efforts have largely been on ensuring that education is easily accessible but very little attention has been paid to the quality of that education. For example, the Bill of rights provides that all citizens have the right to education and to access it in the official language of their choice (Republic of South Africa, 1996). While that indeed speaks to the question of accessibility, it does not address the question of the quality of that education.

The question that can be posed then is what can be considered good quality education? According to Sterling (2001, p. 3), good quality education implies four descriptors: sustaining, tenable, healthy and durable.

- Sustaining; it helps sustain people, communities and societies
- Tenable; it is ethically defensible, working with integrity, justice, respect and inclusiveness
- Healthy; it is in itself a viable system, embodying and nurturing healthy relationships and emergence at different system levels
- Durable; it works well enough in practice to be able to keep doing it.
In this regard, while it is important to ensure that all are afforded opportunities to access education, it is equally important to pay attention and actively ensure that the form of education that is provided is able to efficiently meet the needs of society. In fact, the UNDP’s report emphasised that while enrolment and retention rates have been increased significantly, what is also important is that the government translates this achievement into “educational transformation and improving the quality and functioning of education” (2013, p. 37). In the information society, it becomes even more significant to ensure that the kind of education citizens acquire stays relevant for the increasingly digital work environment. The quality and relevance of education is what determines, to a significant extent, the employability of those who acquire it. The South African educational system faces a challenge of a lack of quality assurance implementation. As a matter of fact, South Africa’s education is rated nearly at the bottom of the class, coming 140 out of 144 countries that took part in the World Economic Forum study in 2013.

What has become clear is that the educational crisis in South African is not a result of financial constraints, as the country has a significant budget allocation for education. In the 2012/2013 fiscal year, the government invested R207 billion in education. The challenges of education are much more complex, and financial allocation is only part of the solution. The Department of Education in 2000 identified some of the challenges as relating to a lack of proper training for teachers, a lack of learning materials and their inefficient use in a classroom environment (Department of Education, 2000). Over a decade later, the educational crisis remains a significant challenge and poor teaching and learning continues to affect the real lives of the majority of students in the country. The shortage of teachers in public schools continues to be a significantly inhibiting factor to teaching and learning in South Africa. Central to these challenges the underlying problems are those related to maladministration and mismanagement, but also the gap between policy and policy practice (Fiske & Ladd, 2004).

**ICT in Education**

The use of technology in education is not a new practice. Broadcasting technologies such as radio and television have been effectively used in many societies to educate students in different areas, including rural areas. However, ICT came with a new and greater aspect which not only enables instant, easy and wider access to information, but also supports inventive creation of knowledge for innovative development (Castells, 2000). The potential of ICTs lies in their ability to make teaching and learning an interactive, diversified process that can stimulate self-initiated knowledge gain. This can thus transform education by encouraging learners to be more creative in their learning. Educational transformation is not only the result of a well-managed educational system but also of a “paradigm shift”, which occurs when people change their thinking pattern and break the walls that restrain the methods of teaching and learning (Sterling, 2001). There is no doubt that ICTs have the potential to enable educational transformation and reform (Tinio, 2003, p. 3).

Additionally, the use of digital means to acquire information reduces the cost of learning through printed materials that need to be physically transported before learners could have access to them. One of the practical factors that inhibits teaching and learning in South Africa is that learning materials that need to be physically transported are often not delivered on time (Pade-Khene, 2012, p. 48). Hence, the use of ICT would ensure that learning is not significantly affected by such logistics as learners would be able to, given minimum guidance, initiate their own learning.

However, despite all these advantages of ICT in teaching and learning, it is worth admitting that access to ICT, particularly in remote areas, remains a significant challenge. Even more problematic is the sustainability of the engagement of ICT in rural areas. The section that follows discusses some of the perceived challenges of the engagement of ICT in rural areas.
Barriers to Use of ICT in Rural Areas

Rural areas are often challenged by a lack of resources (physical, financial and human) as well as infrastructure. All these being the necessary ingredients for effective engagement of ICT in any development initiative, it becomes difficult for ICT initiatives to thrive in rural milieu. As indicated by Bayes (2001) and Bhatnagar (2000), in most developing countries infrastructural inadequacy expresses itself in a lack of technology, the scope of resources availability, and the quality of services. The immediate challenge in integrating ICT in remote areas, therefore, is that of cost. Not only is it too expensive to engage ICT in rural areas, but is also very challenging to maintain the operation of ICT devices in an environment where human resource is lacking.

In most rural areas there are no technically knowledgeable people who can maintain ICT devices such as computers. Some of the teachers themselves do not know how to use computers, and therefore, engaging the use of computers in teaching in such cases is almost impossible. Even though there have been advances in the use of mobile phones, which may enable learners to have easier access to digital learning (Aker & Mbiti, 2010; Etzo & Collender, 2010; James & Versteeg, 2007; Lesame, 2014; Sethole et al., 2013), the limitation of mobile phones is that accessing documents which are large in size may be problematic. Computers are still the best way to access learning materials because of their size and capacity in terms of performance.

A lack of or unwillingness to engage effective participation strategies in planning, implementation and evaluation of ICT4D initiatives, is undoubtedly one of the inhibitors of ICT4D success (Best & Kumar, 2008; Tongia & Subrahmanian, 2006). Ironically, over the years research has revealed that the exclusion of the local people in the affairs of their own development is a counter-productive strategy, and this has made local participation to be a well-recognised practice and a central concern in rural development projects (Bergdall, 1993; Cornwall, 2008; Roodt, 2001; Tembo, 2003; Tosun & Timothy, 2003). Yet when these development projects involve ICT, the local people are being excluded. There is a consensus that ICT can, in fact, enhance local participation in many development programmes through the use of technologies such as e-government, e-health, e-judiciary, e-learning, etc. but the engagement of these technologies, surprisingly remains an exclusive process. This exclusion increases the chances of resistance from the potential beneficiaries’ side, and it creates an environment which is not conducive for the sustainability of projects.

Mentioning a lack of participatory strategies as one of the challenges, however, does not suggest that there are no pre-existing conditions that may negatively affect the engagement of ICT in rural development initiatives. There are also cultural barriers that may certainly affect the implementation and sustainability of ICT4D initiatives, even though, on the contrary, personal observations do suggest that more and more people, including those in rural areas are becoming more open to the use of technology as a way of improving the quality of life. In fact, this research has also proven that the use of technologies, at least in relation to mobile phone, in the selected communities of the Dwesa region, has increased significantly. According to the baseline study of the SLL, which was undertaken in 2008, only 27% of the studied population had access to a mobile phone, either through owning one or having a family member who owns one (Pade-Khene et al., 2010a). Five years later (in 2013) this research reveals that about 90% of the studied population from the same areas have access to a mobile phone. While this does not give the entire picture on the question of cultural barriers and the use of technology, it may suggest that more and more people are accepting of technology, even though, on the other hand, it may be because mobile phones are becoming more easily accessible. The next section consists of a discussion of the Living Lab model, and its potential in addressing some of the above-discussed barriers to use of ICT.
The Living Lab Model for Effective Engagement of ICT in Rural Settings

The Living Lab model is an eco-system that enables community members in collaboration with other stakeholders in society, such as researchers and the government, to explore and co-create new technologies for social and economic advancement (Folstad, 2008; Gumbo et al., 2012; Khane et al., 2012). This model allows for the co-design, development and validation of new technologies, products and services by users in real life environments (Almirall and Wareham, 2008; Bergvall-Kareborn et al., 2009; Eriksson et al., 2005; van der Walt et al., 2009). The model is favourable for collaborative relationships between the different sectors in society, in their efforts to initiate or support the development and engagement of ICT in development activities. The model can be applied to all areas of development including socio-economic and education.

Traditionally, the Living Lab model was predominantly adopted in the business or corporate environment. Through this model, different organisations that utilise technologies would be brought together with the aim of improving their existing technologies and creating new technologies for the improvement of their productivity (Niitamo et al., 2006). The main advantage of this model was that it created an environment where primary users could co-create these technologies with developers (Almirall & Wareham, 2008). It then became clear that this model can, in fact, be utilised not only in the corporate environment but it can also be adopted by research institutions, policy makers, public organisations, etc. (Santoro & Conte, 2009). This enabled the applicability and relevance of this model to be expanded to, technically, all types of services as mentioned earlier. Hence, the adoption of the Living Lab model became highly favourable in ICT for development initiatives.

Through this model, four main sectors in society (government, private organisations, communities and academia) can come into a co-creation process, each one with a complementary role towards effective engagement of ICTs in development processes. The role of researchers from academia is to design and create innovative ICT products and service provision applications in close collaboration with the target users (Dalvit et al., 2012; Gumbo et al., 2012; Khane et al., 2011). This does not only enable primary users to be familiar with the products that they will be using, but also ensures that the products are designed, developed and deployed in a manner that ensures relevance and sustainability. In many cases, ICT products and services are copied from other contexts (mainly urban) and adopted in rural areas without taking into consideration the spatial and contextual differences in urban and rural settings (Heeks, 2008; Steyn & Johanson, 2011; Tongia & Subrahmanian, 2006). This often results in the creation and development of unusable services and products that do not add value or improve the quality of life in rural areas. The advantage of the Living Lab model is that user specifications are factored in through collaborative ICT design and development, and this ensures that relevant products and services are designed for rural contexts.

Within the Living Lab model, the products which are designed should be tied to long-term, national development goals (Unwin, 2009); hence the role of the government as the sector responsible for national policy making is highly embraced. Furthermore, the government already has a mandate to deliver basic services to citizenry, and this model can create, through collaborative relationships, an environment suitable for improvement of service delivery (Hecita, 2009; Zambrano et al., 2009). The products which are designed and developed in this partnership, can improve service delivery, as well as communication and information flow between the government and the citizens, an example of which is e-government. The role of government in this partnership is imperative, not only for creating an environment suitable for implementation and engagement of ICT through policy making, but also in governing how such ICTs are integrated. This can be ensured through comprehensive, relevant policy making and effective policy practice.
The role of communities in this collaborative environment is not only to provide informative ideas during the co-design, co-creation and validation processes, but also to ensure sustainability of the products and services by taking up the responsibility of ownership of the projects. Research has proven that a lack of participatory strategies lead to the inability to take ownership on the local communities’ side, hence the high risk of interventions falling apart even before they take-off (Gurstein, 2006; Merritt, 2012). While it is common practice in rural development projects to include the local people, the opposite is the case when it comes to development projects that utilise ICT. Hence, participation of primary users is a crucial element of the Living Lab model.

Lastly, because, as indicated early, the immediate problem in the engagement of ICT in rural development projects is that of cost, private organisations play the role of financing such initiatives in the Living Lab model. The difference with this model, however, is that these private organisations are not only coming in their capacity as funders but also as long-term partners. That is, the idea is to have them provide funds to enable long-term service provision to rural communities, from which they, as private organisations, can also benefit. If the company is interested in providing ICT services that enable health care monitoring, for example, then, it can provide financial means to set up the necessary infrastructure and make profits from costing on-going services to community members. According to Pigato (2001, p. 3), studies have shown that even in rural communities, less privileged people are willing to pay a small amount to get the services they need in their own local communities. Also, private organisations are open to supporting community development activities in exchange for reduction of taxes, marketing and advertising, as well as expanding their markets.

The Case of the Siyakhula Living Lab (SLL)

The SLL was initiated in 2006, as a joint venture of the Telkom Centres of Excellence at the Universities of Fort Hare and Rhodes, as well as rural communities in collaboration with the private sector and the government. The SLL is based in the Mbashe Municipality of the Eastern Cape Province of South Africa. The state of education in this region is no different from many of the rural regions in South Africa, in fact, in most African countries. The quality of education and students’ performance are compromised by a lack of resources, including learning materials and equipment, teachers and relevant technology. Because of the physical isolation of these schools, simple logistics such as the delivery of textbooks are often compromised; schools receive books much later than the time they order them. When the books are delivered to the Department of Education (DoE) in the nearest town, the schools authorities still have to travel long distances to collect them (Pade-Khene, 2012, p. 48). The nearest town where the DoE office is – Idutywa – is about 73km from the Dwesa region, on gravel road. Hence, there was a need for intervention of the private sector, academic institutions and the government. These sectors together with the communities in the Dwesa region – and later the Mbashe municipal area – formed the SLL, which would work towards enhancing information distribution and innovative development in these communities.

‘Siyakhula’ is a Xhosa word that means ‘we are growing’. The name Siyakhula resonates with the objective of the project, as it aims to grow sustainably in innovation (Pade-Khene et al., 2010b, p. 598). This initiative was started with the aim of enhancing innovative development in the affected communities. Some of the areas of development included information distribution and improvement of communication between these communities and other sectors in society. This would, in essence, encourage participation of rural communities in the affairs of their own development in the information era. The idea of ICT engagement in the given communities was inspired by the realisation that rural communities are often excluded from the global knowledge economy, yet they do have potential as emerging markets, particularly in developing countries (Dalvit et al., 2007; Gumbo et al., 2012; Siebörger & Terzoli, 2010; Thinyane et al., 2007).
When it started in 2006, the SLL was set up at the five schools situated within the Dwesa-Cwebe area in the Mbashe municipal area. These schools are: Nondobo, Mpume, Ngwane, Mtokwane, and Nqabara. The project later expanded to include other communities within the Mbashe Municipal area, and is now hosted by a total of eleven schools (Dalvit et al., 2012). The initiative aims to empower the communities with appropriate innovations and services to actively participate in development activities. The students in the schools are mainly targeted as users, in an effort to improve their access to information and the quality of their education.

The SLL exists as a collaborative initiative involving the four main sectors – the government, academia, communities and the private sector – in their attempt to develop and deploy innovative solutions that can better serve the communities, including the schools within these communities. Desktop computers and wireless network have been provided to the schools through the collaboration of the four main stakeholders. Through this initiative, users have an opportunity to participate and influence the design and development of innovative products (Gumbo et al., 2012). This means therefore that, ICT applications which are developed to aid teaching and learning in schools, such as e-learning, are able to capture user-specifications as a result of effective engagement of primary users. These primary users also have the opportunity to interact with the products from the very early stage, which can help to lessen the complications that come with using unfamiliar products.

Findings of the Research and Discussions

The research explored the potential and reality of the Living Lab model in a specified case study, and this included looking at its impact and potential on a wide range of development aspects including social, economic, governance and of course education. For the purposes of this paper, the only findings which will be discussed are those relating to education. Since its inception sixteen schools have been equipped with computers and network access. This enables the learners to have access to information without having to solely depend on printed material. Because it would have been difficult, possibly even unrealistic, for these rural schools to afford computers, not to mention the Internet provision, collaboration with other sectors has addressed the issue of the lack of resources. However, as will be reflected in the shortcomings, learners’ access to these computers has not gone without constraints.

Also, it was indicated earlier that one of the challenging factors of ICT engagement in rural schools is that in some cases the teachers themselves do not know how to use computers, this was the case in the studied schools. Through the SLL, the teachers in these schools have been provided with computer skills through the Advanced Certificate Education (ACE) program specialising in ICT. This program has been facilitated by Rhodes University, and to this far over twenty teachers have benefited from this program. These teachers can now transfer their skills to their learners, which serves to improve the relevance of rural education for the increasingly digital work environment in the information society. The knowledge-based economy in the information era requires that people efficiently learn new skills within a short space of time (Zhang et al., 2004, p. 75), hence it is essential for education in rural schools to keep up with the time.

Furthermore, through collaboration with academic institutions and the private sector, the strides have been made to develop applications that will enhance the use of ICT for effective, innovative learning. An example is the e-learning platform which has been developed and will be deployed in these schools in the future. Through interaction with learners and other community members, researchers were able to solicit and capture user requirements in the design and development of this application. For example, the language of preference, the types of materials users would like to have access to, etc. Interactions with users occur through arranged meetings as well as through their regular visits and use of the available computer labs, where researchers from Rhodes University and Fort Hare get to meet with them.
The developed e-learning platform will enable learners to interact with their peers and teachers instantly and at any time. Furthermore, learners will have access to more diversified information, which will possibly improve their ability to analyse and synthesise information for better knowledge gain. While e-learning does not replace classroom learning, it certainly enhances the methods of learning as it transcends the limiting walls of the classroom environment, and exposes learners to multiple opportunities of acquiring information and knowledge (Zhang et al., 2004).

**The Shortcomings of the Siyakhula Living Lab (SLL)**

While the idea of the Living Lab model is so comprehensive, it does not go without any limitations. The SLL also has its own specific shortcomings. Even after many years of its life, the challenge of the initiative is that of a lack of political will and continuous commitment from other partners – private organisations and the government to be specific (Mosuoe, 2013). The aim of the model is to ensure that all partners collaborate effectively, yet it is clear that private organisations, for example, see themselves only as funders instead of long-term partners in the SLL. Evidently, there is a missing link in terms of establishing how these companies or organisations can launch long-term service provision that can enable them to earn returns on a continuing basis, while at the same time serving the needs of the communities. Furthermore, the government is still reluctant to go beyond research funding and policy making, to engaging the potential ICTs in their on-going service delivery (Mosuoe, 2013).

Moreover, national level policies have also proved, ironically, to be one of the constraining factors to the engagement of ICT for teaching and learning in the studied schools. One of the findings in this research is that in previous years, computer literacy was one of the subjects taught at the studied schools, subsequent to the provision of computers through collaboration with private organisations. However, since 2012 the learners have not been able to have computer literacy classes or use computers, as the Department of Education ruled against it on the basis that it is not included in the curriculum (Mosuoe, 2013). This goes to show that the use of ICT for development is not only a question of availability of technology, but also of active buy-in from all relevant sectors, particularly the government as the regulating entity.

However, there is hope that the current situation will be improved in the near future. During the launch of the expanded part of the SLL in 2013, the senior educational officer based at the Department of Education in Idutywa said in her own words; “...we as the department are working on, and are now very close to including ICT in the educational curriculum...the aim of the government is to produce ‘digital-wise’ generations for the information society.” The SLL is already a step ahead in ensuring that this vision of the government becomes a reality, by providing the Internet and computers to the schools in rural communities (Mosuoe, 2013). Furthermore, the initiative ensures that technologies are developed and deployed in an effective, sustainable manner, in order to transform education in a long-term.

One of the shortcomings of the Living Lab model, which is not only applicable to the SLL, is that the very same aspect of the model – stakeholder collaboration – may be an inhibiting factor if careful considerations and compromises are not embraced throughout the planning, implementation and evaluation stages of initiatives. Because different stakeholders have different interests and ideas of how the same objective may be achieved, such differences predispose initiatives to conflicts and sometimes divisions (Pade-Khene et al., 2013). This, therefore, means that if collaborative efforts are to be successful, all stakeholders need to be aware of this fact and be intentional about reaching and welcoming healthy compromises.
The Investigative Methods

The research that informed this paper was carried out in the Dwesa region of the Eastern Cape Province of South Africa. Although the SLL has now expanded beyond the Dwesa region to other community schools in the Mbahse municipal area, this particular research was constrained to the four schools in the Dwesa Cwebe area – Ngwane, Lurwayizo, Nqabara, and Nondobo. The research used a combination of both qualitative and quantitative approaches to research. Qualitative methods – interviews and focus group discussions – were used as the methods of data collection in a case study as a qualitative inquiry. A survey using questionnaires, and documents review were adopted as the methods of data collection in a quantitative inquiry.

A case study was undertaken over a period of one year. This case study was structured into three phases; the orientation and overview, the focused exploration, and the member checking phases (Pickard, 2007). During the initial phase, field work was undertaken mainly to familiarise with the study site, build a rapport with community members, as well as to identify potential respondents. In the second phase – focused exploration – potential participants had been identified, interview guides had been designed, the interview schedule had been drawn, appointments with respondents were arranged and data was collected through interviews. Different interview guides were designed for different categories of respondents; teachers, learners, researchers from the two universities involved – Rhodes and Fort hare – as well as other community members who participate in the SLL. Then the last phase – member checking – involved focus group discussions with different categories of respondents to bring in a collective conversation with respondents as fieldwork was coming to an end. A survey was also carried out as the last exercise in the data collection process, to gather more structured data for quantitative analysis. Relevant documents relating to the SLL were reviewed throughout the study.

Quantitative data was analysed using the Statistical Package for Social Scientists (SPSS). Data from the survey was coded then captured into the SPSS spreadsheet and analysed quantitatively. Coding is a process of assigning numerical meanings to the variables in order to make them machine readable (de Vos et al., 2005). Qualitative data was analysed through content analysis. Data from the interviews and focus group discussions was analysed qualitatively, taking note of statements, anecdotes and examples relevant to the research objectives (Mosuoe, 2013, p. 116).

Suggestions for Future Research

As mentioned earlier, this research did not only focus on the education aspect of the impact of the SLL, hence the subject was not fully explored. It would be necessary to assess the impact of the engagement of ICT on teaching and learning in the selected rural schools. Such as comparing pass rates before and after consistent engagement of ICT in the selected schools. This may go to as far as assessing creativity and analytic ability of learners after consistent exposure to ICT teaching and learning methods.

Conclusion

This paper discussed the South African state of education, noting some of the challenges that affect the quality of education in the country. It reflected that the problems in the educational system are not mainly financial but include administration and policy implementation. It reflects that the problems of education are often multidimensional and, therefore, requires complex strategies and measures to address. It further showed that as a result of the challenges faced by the educational system in South Africa, it remains that education fails to keep up with the progressively digital work environment in the information age. The paper also highlighted the significance of ensuring not just accessibility and affordability of education, but also the quality and the sustainability of it, as well as its relevance in the digital age. While there have been efforts to integrate
Living Lab Model of ICT for Development

ICT in education, it remains evident that there are a number of barriers that inhibit the success of ICT engagement processes, particularly in rural areas. The paper, therefore, highlighted some of the barriers to use of ICT in rural areas. It consequently discussed the Living Lab model as an alternative approach that can effectively address some of the challenges of ICT engagement in rural settings. The paper took into account the case of the SLL as an example of the initiatives that engage this model. It shows how teaching and learning can be improved by the engagement of ICT using the Living Lab model.

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### Biographies

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Public Libraries for Local Development

(A Project Concept Paper)

The project is implemented by Public Service Development Agency of the Ministry of Justice of Georgia in cooperation with IREX as part of the Beyond Access Initiative

Implementation period: April 2014 – January 2015

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Abstract

It is widely acknowledged that in order to ensure access to electronic public services and information to the public at large it is vital to identify mechanisms and tools to narrow the so called “digital divide”, so that the whole population can benefit from the public sector reforms. Equality of opportunity in the digital age requires that all individuals, especially those living in the rural areas, have access to online information along with the skills to navigate the internet.

Georgia has approximately 600 public libraries spread across the country, representing an untapped potential that could benefit local communities. Public Service Development Agency of Georgia (PSDA) believes that partnering with public libraries and using them as shared facilities for traditional library and community gathering purposes, as well as adding more value through introduction of ICT technologies will complement its efforts to improve public service delivery at the local level and contribute to the local development. As a result of the present initiative “Public Libraries for Local Development” implemented by PSDA in cooperation with IREX’s Beyond Access Program, libraries will turn into an additional tool by means of which PSDA will further support local government entities and local population and strengthen their capacity. This will lead to creation of a mixture of innovative measures focusing on service delivery improvements especially for those with limited access to internet resources.

Existing public libraries, especially those at the village level, are thus considered as an effective instrument to address the issues of digital exclusion and serve as catalysts for local development. To this end PSDA plans to cooperate with the public libraries to use them as a shared facility to combine conventional library services and Government service delivery, introduce ICT and train its personnel to deliver better services distinct from traditional librarian’s functions.

Keywords: Libraries, Development, e-Governance, ICT, Local Development, Innovation, Public Services
Background

For the last decade Georgia has undergone a process of rapid transformation. Reforms, implemented after nineties, emphasized the rule of law, introduction of e-Governance, fighting corruption and ensuring transparency, and making public services available to the all strata of the population.

Usage of ICT to the great extent defined success of implemented reforms; however not full-fledged country-wide. The “digital divide” is still a serious problem. The level of the population’s ICT skills and internet penetration is quite low, especially in areas distant from regional centers. Many people, even those who visit the library, are not aware that they can find information, fill out applications, and receive public services online. Therefore, the rural population and part of urban population cannot benefit from the developments happening in the country.

This in its turn is creating a mismatch between the supply and demand of new opportunities; supply side is developing rather fast through public and private organizations moving their services into virtual space and offering increased efficiency. However, demand side is lagging behind, as people either do not have access or lack skills to use these services. Besides services, supply of news and information is moving to virtual space, however, the lack of internet access and skills unintentionally excludes part of the population from the ease of exercising their right to access to information and services they are entitled to receive.

The Strategy

The Government of Georgia acknowledges the need to identify mechanisms and tools to narrow the digital divide, so that the whole population can benefit from public sector reforms, especially those connected to e-Government services and access to public information. Equality of opportunity in the digital age requires that all individuals, especially those living in the rural areas, have access to online information along with the skills to navigate the internet. Hence building only powerful supply side for services and information is not enough. Access to ICT requires access to hardware, access to internet and skills. Even if internet and skills is provided, access to hardware, especially acutely in rural Georgia, remains a problem due to the poverty and low income. As development and eradication of poverty largely depends on the use of ICT, lack of access locks rural population in a vicious circle difficult to break. One of the solutions to remedy this shortage identified by the Public Service Development Agency (PSDA) of the Ministry of Justice of Georgia is the creation of public spaces, where facilities are shared among public and private organizations and where people can access computer and internet free of charge. Hence PSDA has undertaken initiative – Development of Community Centers, within the framework of the EU funded project “Introduction of e-Governance in Local Self-Governments”.

Community Centers aim at making public, private, and municipal services accessible for citizens at the village level and equipping them with free access to internet and computers. Community Centers are centrally located buildings (in a village or several villages) housing a Trustees’ office, agriculture or rural life related projects, etc. Community Centers are the center of a particular neighborhood offering multiple, key services for the local population. By means of Community Centers citizens can freely access e-services provided by different levels of government including social assistance, land registration, identification documents (passport and electronic ID), agriculture consultations, and payment of utilities. The piloting of Community Centers proved to be successful convincing Georgian Government to enhance the initiative further and increase the number of the Centers to be constructed across the country.
The above described measure has allowed significant improvements in the process of ‘production and consumption’ of public services, due to substantial innovations in terms of services (what is offered), but mainly in terms of process (how it is offered).

And yet, the above initiative is not enough to comprehensively address the digital divide as it requires substantial investments, which can be difficult to source. Furthermore, it is a matter of expediency to spend all resources in creating something new, when there is a substantial network of unused potential, like public libraries, to build on. Public libraries possess physical space, which is currently under-utilized due to the lack of needs people have nowadays.

Georgia has approximately 600 public libraries (including branches) spread across the country, representing an untapped potential that could benefit local communities. PSDA believes that partnering with public libraries and using them as shared facilities for traditional library and community gathering purposes, as well as adding more value through introduction of ICT technologies will complement its efforts to improve public service delivery at the local level and contribute to the local development. As a result of the present initiative libraries will turn into an additional tool alongside with Community Centers by means of which PSDA will further support local government entities and local population and strengthen their capacity. This will lead to creation of a mixture of innovative measures focusing on service delivery improvements especially for those with limited access to internet resources.

Along with investing in a new type of infrastructure in the form of Community Centers, existing public libraries, especially those at the village level, are also considered as an effective instrument to address the above issues and serve as catalysts for local development. Thus PSDA plans to cooperate with the public libraries to use them as a shared facility to combine conventional library services and Community Center functions, introduce ICT and train its personnel to deliver better services distinct from traditional librarian’s functions.

The pilot project to be implemented in 2014 (April 2014 – January 2015) will cover 4 selected libraries (Zugdidi, Khulo, Khidistavi and Nukriani Libraries) comprising a mixture of village and municipal-level libraries. The initiative will aim at introducing the concept of Community Centers into the selected libraries and equipping them with modern technologies (internet, IT equipment, new books and related literature).

**The main objectives of the project are to:**

1. Ensure access to public information through libraries
2. Improve communication between the local population and the local government
3. Build the capacity of the local librarians and assist them in mastering e-Governance tools
4. Conduct public awareness campaign and contribute to spreading e-Governance at the local level.

**To achieve this following sub-objectives have been identified:**

1. Bring physical space in the pilot libraries up to date, thus making them comfortable for visitors
2. Equip libraries with internet access and computers
3. Develop ICT skills transfer mechanism to librarians and library facility users
4. Renew library resources, so that the libraries regain their role of a place nurturing the process of discovery
**Project Overview**

**Modernizing libraries**
The initial phase of the project will focus on four libraries in two villages and two municipalities. All four libraries will reopen with more “modern” looks and be equipped with new computer workstations and WiFi throughout. The modern libraries will feature open, welcoming environments, meeting rooms, and multiple Internet access points. This will allow libraries to serve the current needs of the population and become Community Engagement Spaces — places where residents can come together with local businesses, NGOs, or government officials to address community needs.

**Training librarians**
The modern libraries in Zugdidi, Khulo, Khidistavi, and Nukriani will require “modern” librarians – that is to say, librarians who are not only familiar with all the services of the new libraries, but can also assist library visitors in using these services to their best benefit. The project will deliver three phases of trainings to project participants. The first phase will focus primarily on basic IT skills and how to teach these skills to others. The second phase will focus on delivering new services, including e-Government. The final phase will focus on access to information and project planning and implementation, giving participants the tools needed to develop and execute programs beneficial to their community. These trainings will include librarians from the four partner libraries, as well as librarians from nearby libraries, local community organizations, and municipal offices, to ensure that all sectors can appreciate the benefits.

**Connecting citizens to public services**
Through partnerships with the PSDA and private companies, the four participant libraries will help their patrons access e-government services, mobile companies, financial information, and a host of other beneficial resources related to citizenship and migration, social assistance programs, and social-legal certifications. The libraries in Nukriani and Khidistavi will house the same 17 e-Government services offered by PSDA. In addition to being able to train patrons on different 21st century skills, the librarians involved in the project will also work with them to identify information needs and direct them to the appropriate resources.

**Vision for a modern library**
A modern library should:
- ✓ Provide Citizen Services
- ✓ Have comfortable environment
- ✓ Provide access to technology
- ✓ Training/digital literacy
- ✓ Provide access to information (through different means such as books, newspapers, internet, radio and TV)
- ✓ Consultation (librarian hotline)
- ✓ Build partnerships (Gateway between citizens and different organizations and programs)
- ✓ Serve as a space for citizen engagement
- ✓ Poses open stacks/books
- ✓ Offer online services

**Library position and partnership opportunities**
Already for a couple of decades libraries experience scarce funding. The latter resulted in damage to infrastructure, lag in development, loss of consumers and lack of motivation among librarians. The situation has worsened also due to isolation and low awareness of librarians on new developments and opportunities given by modern technologies that could bring about change. Although there were a few attempts of intervention aiming at mentality shift and awareness raising
among the librarians and respective governmental bodies the impact was minimal. However, there are some success stories. The National Scientific Library of Georgia is a good example; it made a significant contribution to the introduction of modern tools in libraries and initiated establishment of Libraries Association that helped to bring the librarians community together. Initiatives of the Association to contribute to the libraries’ improvement were not always supported and encouraged by the respective Government bodies; hence the attempts were not sustainable and were rather sporadic.

As soon as PSDA became interested in libraries’ potential to enhance its initiative enabling to provide population with more free access points, it started searching for partners. Along with Libraries Association PSDA approached National Parliamentary Library of Georgia (NPLG). NPLG is distinguished for its successful experience in the usage of ICT. As a result of its efficient approach notion on NPLG among the population is very high. NPLG is widely using social networks to highlight events and projects implemented by the Library. Moreover, NPLG’s premises are actively used for different purposes starting from hosting various exhibitions ending with meetings of politicians. This is a vivid and real-life example to follow.

Public libraries need to become focused on the challenges and needs of their users. They need modernized infrastructure allowing visitors to read silently, discuss their discoveries in the space purposefully designed for it, use computer facilities and obtain guidance on how to effectively receive full benefits of the facilities offered. Therefore there are two main aspects which need to change - physical infrastructure and attitude towards how things can be done, requiring awareness, training and support.

Factors which contribute to the lack of doing the above mentioned are mutually reinforcing - lack of funding and lack of motivation. Lack of funding is justified through the idleness of libraries, low number of users, thus not getting it into the list of priorities when finances are scarce and socio-economic situation is rather poor. At the same time, without necessary funding, libraries do not possess the capacity to make their facilities more attractive, so that it changes from idle place into a lively community space. Therefore considering the libraries from a different perspective, through a lens of e-Governance, is essential for bringing new life to libraries, creating a viable model and then using this success story for advocating for the support along with other libraries.

Currently a few libraries and civil society organizations in Georgia, with the help of donors are working on creating precedents of libraries, which can attract users. Thus the aim of PSDA, through this project, is to add value to these efforts and to create a model which unifies all the above stand-alone initiatives into one unified concept. The latter also includes an important new element - provision of e-Government services and other support activities, hence bringing more interested parties enabling sustainability and development.

Along with the delivery of the assigned public services, libraries similar to the Community Centers should become an efficient instrument fostering civic engagement at the local level. One of the key conditions creating an impetus to civic engagement in decision making processes is access to public documents and freedom of information. Information must be accessible to general public; thus public libraries can play the pivotal role here. Therefore, PSDA approached the Institute for Development of Freedom of Information (IDFI), an organization the main mission of which is to promote transparency of public information and Governmental accountability in Georgia and consequently received IDFI’s commitment to partnership within the framework of the project. The organization also actively supports the development of modern electronic Government, e-Participation, e-Democracy and e-Transparency in Georgia.
Conclusion

Delivery of government services online is a key component of a transparent and accountable government. There are more than 230,000 public libraries in the developing world that are safe, inclusive spaces that could provide free internet access and be a typical location for people to use e-governance services.

If as a result of the PSDA’s pilot project “Public Libraries for Local Development” libraries can reinvent themselves and embrace an expanded role of public service providers combined with an equally important role of online information centers, the impact on the individuals and communities at the local level will be substantial. The libraries can also serve as sustainable partners to Government and other stakeholders on the regional level.

Hence through the above described initiative PSDA strives to build on the untapped resource of public libraries in Georgia and develop them into a modern space enabling local access to information and services through shared contemporary community space. Apart from serving as an important platform for improved access to information and services, the library development initiative also aims at: a) development of local opportunities at the rural level 2) bringing voices of local population online 3) enabling civic engagement by linking government with citizens.

IREX’s Beyond Access Program, as a major supporter of PSDA in the given initiative, has vast expertise in bridging this “digital divide” by both promoting awareness of the resources available to citizens and training librarians in how to help citizens efficiently access these services. Thus, a team composed from all relevant actors backed by their experience and expertise has been formed to accomplish a common goal — transform Georgian public libraries into the engines of local development.

Biography

Nana Tsiklauri joined Public Service Development Agency of Georgia in August 2013 as the Head of International Relations and Donor Coordination Division. Since then she became actively engaged in establishing partnerships with various international organizations and donor agencies working in the Governance domain. She is also intensely involved in the design and implementation of various projects and initiatives of the agency aiming at improving public service delivery in Georgia with a strong citizen-centric approach and focus on e-governance and public service innovation.

Before joining PSDA, Nana has been working with a number of international agencies and local NGOs in the field of development cooperation in various sectors. Her experience in the public sector is underscored by a Master’s Degree in Public Policy and Administration from the London School of Economics and Political Science (LSE), Department of Government and a Master of Public Administration Degree from the Georgian Institute of Public Affairs (GIPA). She also holds a Bachelor’s Degree in International Relations from the Tbilisi State University.

Over the last years she has focused on Decentralization and Local Governance issues, agile Governance models and citizen-centric public services. As part of the ongoing projects she is actively involved in initiatives aiming at introducing innovations into the way public services are designed and delivered, fostering e-skills development, and application of design thinking and behavioral insights to inform public policy.
house4hack: Stimulating Technical and Practical Innovation for Social Good

[Discussion Case]

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Case Overview

How can we stimulate more active involvement and valuable partnerships in creating more relevant mobile apps, engineering or other technical artifacts for South Africa and Africa?

John Burger, the founding member of house4hack, despite his passion for social good using practical innovation, was fully aware of the cost of getting people and organizations actively involved in social enterprises. The successful electrical and electronics engineer with a number of academic (PhD and Masters – cum laude) and corporate accolades (executive in a top firm) had already been at the top of the corporate ladder. But despite the success, his stronger desire to see South Africa become a net producer of IT and technical artifacts rather than a net importer had led him to rethink his entire life strategy. After deep discussions on the merits of free and open source software development with two friends, they decided to start house4hack as a non-profit organization. The main purpose of house4hack was to provide an innovative environment, a hacker space, where members could conceptualise and create innovative technical artifacts which are well suited for the South African and African environment. The emphasis of house4hack was on making available technical equipment and working space so that members had an environment in which they can experiment and develop technical artifacts. An example of a technical artefact that emerged from house4hack is Robohand. Robohand is a mechanically driven artificial hand printed using 3D technology. Robohand has depended exclusively on donations to develop and distribute artificial hands to people who cannot afford them such as in the war torn areas of South Sudan.

It was now three years since house4hack started. The hacker space was exciting, new ideas and opportunities kept emerging at the Tuesday meet ups where members and visitors networked and collaborated on new techniques or technology they had come across. But despite the liveliness, there were some key questions and critical decisions on John’s mind:

1. How do we get more people involved in creating artifacts?
2. Where do we find seed funding to support house4hack?
3. Are we serving Africa well enough with relevant artifacts?
4. Am I falling right back into the corporate work lifestyle trap?
Groenpunt Correctional Services: E-Literacy Training for Staff and Inmates
[Discussion Case]

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Case Overview

Schalk van der Sand pondered this question as he considered how he could go about e-literacy training for staff and inmates. He now found himself thinking about the things he needed to accomplish in order to execute his mandate as training manager at Correctional Services. What was missing was the e-literacy skill set required to take advantage of the government’s e-skills training programme as indicated in the National Development Plan.

Van der Sand realized that he had a range of options. At one extreme, he could “throw money at the problem,” by hiring professionals to take care of the training functions such as promoting, presenting and certification. Solutions following this principle would allow him to choose among the best of the service providers and ensure high levels of professionalism within the Correctional Services. At the other extreme, he could continue with the training as provided by the CoLab during the pilot study during the previous financial year. This option would allow him to focus on other training activities and less on the management of private service providers. This would conserve cash-flow, but leave him with more day-to-day responsibilities.

Like most decisions he had to make, Van der Sand knew that this decision too needed to be made quickly. There was a new Human Resource Manager appointed at the Correctional Services and he wanted to present the recommendation to him in order to start the e-Literacy training as soon as possible to be able to issue certificates to the interns that are currently employed at Correctional Services.

Keywords: case study, discussion case, E-Literacy Training, South Africa

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Case Overview

The Strategic Plan for the Department of Communications, The Institute (NEMISA, ISSA and E-SI) indicated that it will provide and enabling environment for a coordinated response to the challenges posed by the rapidly expanding capacity, mobility, convergence and affordability of new ICTs and their impact on the country’s competitive position i.e. job creation, socio-economic growth, innovation and creativity, and address inequity in a developmental context. It further will provide a decentralised collaborative architecture to establish new collaboration across government, business, education and civil society that build the capacity of South Africa’s developmental state to effectively participate in the new Information Society and Knowledge Economy that is increasingly responding to the rapidly developing, converging, mobile and affordable.

In summary the Institute will focus on training Communities (citizens, unemployed, women, youth, physically disabled) 10 million basic e-literacy skilled citizens (social appropriation of technology).

In light of the above the Northern Cape and Southern Gauteng CoLab with the thematic area of the Knowledge-based Economy and e-Social Astuteness has introduced the training of the e-Literacy training programme to councilors of the Khara Hais (Upington) Municipality in the Northern Cape. The pilot training programme has successfully been completed during 2013 and discussions are underway to continue with the implementation model while learners are in the process to be identified.

Keywords: Discussion Case, case study, e-literacy, Khara Hais
Abstract

Building an ecosystem in software engineering is a dramatic challenge due to the differences in the objectives and goals of the participating sides: governmental, industry, academic, and research organizations. The paper describes the plans and first outcomes of the recent Russian startup, the ambitious Innopolis project. The new city is under construction next to Kazan’, the capital of Tatarstan Republic. The idea is to use the synergy of IT academicians, researchers, and practitioners in a single location. The city will incorporate a kindergarten, a STEM training school, a university, and an IT park. According to the construction plan, by 2030 Innopolis’ population will total 155,000 people including 10,000 students of the first ever 100% Russian IT university. The Innopolis University acquires the best experience from world-known software engineering schools. The new Kazan’ satellite city will provide high-end residential conditions and recreation facilities in an ecology-friendly environment. The first project results are constructing the basic infrastructure, professors and instructors training, building strategic alliances with leading universities, governmental and industry organizations, and IT companies.

Keywords: software engineering, software development skills, software engineering education, software engineering ecosystem, innovative skills.

Introduction

The objective of the paper is a systematic outline of the lessons learned by the author while being trained in software engineering at Carnegie Mellon University (CMU). The training purpose was curricula developing for Innopolis, a new innovation IT ecosystem, which is currently underway in Russia. The overall Innopolis project idea is to bring together education, research, and practice, and to create a unique IT city for versatile software development with well equipped labor recreation facilities. Currently, the project is in its initial stage.
host around 150,000 inhabitants by 2030. The Innovative City will become Kazan's satellite - the capital of Tatarstan is just 20 miles away. One big challenge is that the entire Innopolis infrastructure is being built literally from scratch: currently the nearby surroundings are uninhabited. The other obstacle is to manage the differences in the objectives and goals of the multiple participating sides: governmental, industry, academic, and research organizations. However, the initial idea to integrate the powers of the two governments, IT academicians, researchers, and practitioners in a single location will likely assist in coping with these difficulties.

Innopolis will support the entire lifecycle of IT people; the city will incorporate a kindergarten, a STEM training school, a university, and an IT park. Of these, the university is chosen as the primary focus of the paper, since it is to become the brainpower of the future city.

Concerning the Innopolis University, quite a number of aspects are essential. However, the paper focus is specifically master curricula in software engineering. The choice is made because of the author's recent CMU visiting faculty experience. The purpose of the training was to identify the ways to adjust the CMU curricula in software engineering and IT to meet the requirements of the new Russian innovative initiative.

CMU has been chosen for Innopolis faculty training since this is the birthplace of software engineering, and the top ranked university in the SE and IT field (“Colleges Rankings and Reviews,” 2014). The CMU SE master's program is a well-balanced alloy of research and project practice, core and elective courses. However, direct curricula copying from CMU to Innopolis is not an entirely correct solution because these two universities obviously have certain differences in their training goals. So, the paper discusses possible ways of context-specific adjustment of the CMU courses to meet the new Russian university objectives.

The paper is organized in several sections as follows. The Designing the Software Engineering Ecosystem section discusses the Innopolis project and the University development outlines. The Software Engineering: The Start-up section covers the CMU approach to master curricula in SE and IT in more detail. The Lessons Learned at the Carnegie Mellon section contains the major takeaways from CMU. The Application Outline for the Lessons Learned section presents suggestions on SE and IT master curricula tailoring to be applied at Innopolis next academic year. The summary of the lessons learned and suggestions generated is given in the Conclusion section.

**Designing the Software Engineering Ecosystem**

Innopolis is a fairly recent project; it started from scratch in 2011. However, the ambitious idea is to co-locate a number of institutions in a tax-free and ecologically clean environment.

For Russia with its over 250 year university tradition, the new startup is still a pioneering venture. This is so because the university to be built is the first ever 100% IT higher school in the country. Prior to Innopolis, the majority of universities have been either multi-domain classical or technical ones. The school to appear will get a precise focus on applied IT and SE (the research projects to be carried on at Innopolis will also be industry-focused rather than fundamental ones).

The new project will embrace the entire lifecycle of applied IT/SE engineer. That is, the continuous education process will start at kindergarten. Further educational steps will take place at a STEM-based secondary school and the University.

Later on, internship and/or full-scale employment will follow at an IT leading company residing nearby at the technology park. All of the above-named facilities will be “tightly coupled”, i.e., located within a convenient 15-minute walking distance.
The living and working conditions seem to be a lot better than at any other Russian city to date, and the salaries, from university staff to IT cluster employees, will be likely be world competitive.

The location for the new enterprise is unique. The Kazan' city, capital of Tatarstan Republic, is located just between Europe and Asia. The average distance from the city to major European and Asian destinations is around 1.5 hours shorter than that from Moscow. Thus, the Tatar capital is located closer to the geographical center of Russian Federation than Moscow. Historically, Kazan' is an Asian location, however, at present the location is fairly international. 115 nationalities, Muslims, Christians and a number of other confessions peacefully coexist at this location for nearly 1000 years. The city is a megapolis with a population exceeding 1.2 million, a history of over 1200 years, and it is sometimes referred to as Earth civilization birthplace (‘IT University Innopolis, 2014).

Kazan' is a world known academic and research location. Its major university was founded over 100 years ago, almost the same time as Carnegie Mellon, and it is among the top level Russian higher schools. The city has been recently renovated; its new generation infrastructure now is capable to support the top-level international cultural and sport events. A number of large IT companies are located there, represented by either headquarters (such as ICL) or subsidiaries (such as Fujitsu-Siemens). Tatarstan is #5 contributor of nearly $40 billion to Russian GRP, its production annually grows by around 7%.

The dominating sectors are oil-and-gas, automobile industry, construction, transportation, and communication. So, the location potential allows creation of world-class facilities to support the new innovation city.

According to the project plans, Innopolis City is to host over 100,000 inhabitants by 2030. Currently, the university received tuition license of Tatar Education Ministry. The faculty training is underway at Carnegie Mellon University, Pittsburgh, PA, U.S.A., which is top school of SE and IT in the world.

The project has been granted a prominent status of Federal Innovation Platform, which means it is among the strategic priorities of the Russian government. The secondary school STEM Program in robotics has already yielded nearly 1,000 graduates. Seminars of leading world IT scientists and industry representatives are regularly held at the campus, which is currently located in Kazan' and will be moved to Innopolis in 2015.

Construction of the main facilities – the major university building, residential halls and the IT park offices – is underway; it will be complete by the end of 2014. However, a lot of work is still ahead. The roadmap of the project is still in progress; it is to be finished in 2016. The Innovation City development strategy will be completed by 2020.

Though the project outline is somewhat vague at this point, it is clear enough that the university will be the brainpower of the Innopolis. Thus, the school curricula and staff training become critical issues at the moment. They will be covered in more detail in the following sections.

Software Engineering: The Start-up

The foundation of software engineering, as a discipline, has been influenced by a number of factors. One of the key events which influenced this was the historical NATO conference, where the relation between software engineering and material production was clarified (Naur & Randell, 1969). The major conference decision was that, regardless of the fact that SE has much in common with material production, the new area has a number of clearly distinct features, which require a different lifecycle and development approach.
The birthplace of the industry is Carnegie Mellon University, specifically, the Software Engineering Institute (SEI), which is interwoven into the CMU structure and activities. The SEI has been founded as a result of the historical NATO conference decisions. The SEI focus historically has been research and development of large-scale software systems with heavy duty and high reliability. The primary application of such software was military systems requested by the US Department of Defense. Since SEI is the “executive producer” of state-of-the-art standards in SE, such as SWEBOK, the CMU educational standards are probably most close to the industry ones. However, CMU had a long way prior to SEI came into being, and the initial CMU way influenced the training in software engineering a lot.

The CMU was founded in 1900 (Carnegie Mellon University, n.d.) as a synthesis of Carnegie School and Mellon Institute, which were among the leaders in US research in technology and economics respectively. The synergy of the new alloy was so powerful that the new venture quickly became a leading university in the area.

In the 1800s, the Carnegie Technology School was founded by Andrew Carnegie, who came from Scotland to the steel producing area. Among his general ideas was the learning-by-doing approach. This hands-on starting point helped him a lot to train the steel workers' children in a college-like environment. The idea was to deliver the just right amount of knowledge to master the innovative engineering technologies. The approach was practically oriented and the deliverables were real-world engineering systems and projects. The main idea of A. Carnegie's way holds true till the present day; it leads to realistic, well justified solutions for heavy duty software systems with a solid engineering-based reasoning. Such justification is based on rigorous software engineering metrics to guarantee development and maintenance of “good enough” software systems in terms of availability, performance, modifiability, security, usability, and a number of other quality attributes.

One more ingredient of the CMU success was perhaps an early adoption of cognitive approach to software engineering, which has been chosen due to tight integration with a number of psychologists who contributed to foundation of the famous CMU School of Computer Science or SCS (http://www.cs.cmu.edu).

The general framework of CMU curricula is based on the above mentioned factors of learning-by-doing, Carnegie and Mellon schools alliance, interaction with SEI and SCS. Further on the discussion will focus on masters' SE and IT courses, which currently are among the primary concerns of the Innopolis University project.

The following core MS SE/IT courses were examined during visiting faculty training at CMU:

- Analysis of Software Artifacts;
- Architectures for Software Systems (an alternative was an executive course for LG software engineers training on architectures);
- Personal Software Process (PSP).

The takeaways from the above mentioned courses are summarized in the following section, and the ideas of their application to Innopolis University curricula are given in section located directly after the following one.

**Lessons Learned at Carnegie Mellon**

During the training, the primary attention was focused on the Architectures for Software Systems. The course is casestudy-based (especially the LG executive version). It gives clear reasoning to change the chaotic development approaches to a process-driven one, where the general idea is to have a "just right" amount of the process to be efficient. The chief architect is free to adjust the
process to fit the project aims and scope. The course is practically oriented; it is supported by recitations and driven by a real world project (with actual customers involved and actual software product outcome) incorporated into it. Teamwork is well aligned with individual assignments. Perhaps, sometimes the individual contribution of each student to the team project is not quite clear, at least in terms of the final grade, which is heavily dependent upon team results, so a little bit of "free-riding" is quite possible. However, it is not easy for a "free rider" to get an overall pass, since individual contribution amounts to around 30% of the final grade. So, the grading policy is fair enough.

The course approach can be easily scaled up to large projects. The course Studio projects seem to be typically small/medium-scale ones. The ACDM/ATAM framework fits the Studio projects; however, it is often a challenge for the students to tailor the framework in order to fit the project size and scope. This challenge is a strong point of the course rather than a drawback, since it teaches the students to think architecturally and systemically.

Another strong point of the course is the "just enough mathematics" (J.E.M.) approach. On the one hand, the course assignments never violate mathematics. On the other hand, such an approach keeps the course focused on its primary goal, which is to form the architectural thinking.

It is a challenge to master the course. One reason for this is that it requires intuition and influences the way of thinking; these are hard things to do not only for students, but also for some software engineers.

Another MSIT/SE core course examined was the Analysis of Software Artifacts. The course is comprehensive enough. It embraces quite a number of areas, including quality planning, model checking, all kinds of testing, etc. Similarly to the previous one, the Analysis course approaches software quality in a systematic way and focuses on different techniques for quality assurance. Again, I have known a number of courses for software testing, which focus on certain techniques, e.g., "white box", "black box", and state-based testing. The Analysis course is dealing with all the above techniques to a certain extent; however, its overall goal is much broader and more complex. It introduces the idea of software quality improvement throughout the entire lifecycle. It is not just coding and testing which adds to product quality. The development processes also matter a lot. That is why the course includes - along with other standards - a CMMI overview.

Another issue, which contributes to software quality, is security. Again, this is a vast area; however, security relationship to software quality often remains somewhat subtle.

Systemic approach to quality through product security testing adds value to the course. Combinatorial testing, queuing theory, defect taxonomies, and a number of other aspects are presented together in a systematic way, which truly makes this course unique. Actually, the course presents a brief history of quality assurance, and the students are supposed to know the key dates and names. The course is supported by a "launchpad" for hands-on software quality assurance application. There is a large code repository (naturally, with a certain amount of bugs injected), and the students are applying out the quality assurance methods they have just studied in a realistic environment, i.e., to the "third-party" software artifacts.

As for reference and reading materials, these are very well supported. The course is based on a database of publications which totals to gigabytes of information and is easily full-text searchable. It takes a couple of minutes to extract the reference required and several more minutes to incorporate a quotation or a table/graph into a lecture slide. This is an impressive and hi-tech illustration to the quality of this courseware. Also, the course provides a lot of really helpful references for further reading and self-improvement concerning the above mentioned directions (and many more) and potentially assists in postgraduate studies, research, and publications.
The course fits well into the overall framework of the Studio project and requires software quality plan production at certain point. Each student team gets at least a couple of chances to present the intermediate results, and certain methods are used to engage every team not only into project presentation, but also into product quality discussion. Thus, students get the understanding of how and why does the software product quality matter. Teamwork is well aligned with individual assignments. The course is a well-justified combination of individual contributions and team presentations. It is professionally monitored and mentored.

Grading policy is quite clear to the students. The rubrics are clear, concise, and easy to use, feedback on rubrics is instant, so grading is fast and easy, and the result is fairly accurate. The grading policy is explicit and thus fair enough. Also, due to well organized processes and clearly stated "rules of the game", grading is fast and smooth, the students get a clear, well justified and prompt feedback. Teaching assistants are involved not only in lectures, recitations and grading, but also in developing assignments and rubrics.

The "just enough mathematics" approach seems be the right choice for this course as well as for the previous one. Yes, the course potentially requires a lot of more sophisticated mathematics (e.g., specific forms of Petri nets, advanced statistics, etc.). However, these would be seldom (if at all) used by the software engineering practitioners. Still, since the engineering approach has to be rigorous and metrics-based, such metrics (such as throughput) and general laws (such as Little's law) are introduced and applied instantly. Such an approach keeps the students practically focused on thinking of what adds quality to the product.

The course is introducing a way toward more efficient software development. It is not just about coding (design and testing). It is about establishing a process and a standard in development (including planning and tracking) and persistently following them. Planning and tracking takes time and effort. However, it pays for itself. One gets it really straight from the course. The course is a predecessor of CMM(I) standards. Statistics are heavily used to assess current process, detect bottlenecks and/or improvement areas, adjust the planning and tracking process and follow them. Thus, the course is focused at continuous individual improvement, which is quite a value by itself. The basic course book by W. Humphrey (1995) is influential, since it illustrated both how disciplined should the software development process be and how this discipline pays for itself right away and eventually. Also, projecting for the future seems to be a major takeaway of the course. The course, however, is much more than just a number of book chapters. It features a toolkit for personal improvement, which also includes code reviews, Pomodoro technique for time management, and a number of other powerful things. Taken together, they form a Swiss army knife-like collection, which adds a lot to CMU students professional skills, and which is extremely useful and helpful before they actually start their intensive master level studies.

The PSP course is interwoven with the Analysis and Architecture courses since it is focused on quality and planning activities improvement to, probably, the best extent possible. Further process improvement is possible at the team level of the TSP course; however, this is a different story.

The course is supported by the Dashboard tool, which assists in planning, tracking, and estimating. Data analysis is also possible. The course features tools and techniques for data extraction and analysis, which can be performed fast enough. Grading templates are available to speed up the assessment process in case of large-scale remote student groups. The students early enough in the course focus on their individual development skills improvement and this becomes a personal motivator and driver. The more accurately the data is collected and applied, the better future work can be estimated and predicted. The course provides a number of links to current standards and policies of software development, which helps to align it with the future requirements, which the students will probably have to meet.
The course will assist in the Studio projects and their outcomes (it helps to provide document templates, planning strategies, to estimate the progress, to justify the results obtained, and to adjust).

The rubrics are easy to follow, they work both face-to-face and remotely, so grading is efficient and accurate enough. Due to well organized processes and templates, and clearly stated “rules of the game”, the students get a clear, well justified and prompt feedback.

**Application Outline for the Lessons Learned**

The above takeaways analysis resulted in the following considerations concerning their implementation in the MSE/IT program of the Russian Innopolis University.

The courseware set follows general principles of learning-by-doing and just-enough-mathematics. The course set is a great start for the masters' program in SE at Innopolis, since it is well thought through and practically approved at the world topmost software engineering school. Course-specific benefits, issues and challenges are discussed below.

**Architectures for Software Systems**

The course is practically oriented and supported by recitations and a real-world project. Teamwork is well aligned with individual assignments. The grading policy is fair enough. The course can be easily scaled up to larger projects. It is challenging for to tailor the ACDM/ATAM framework to fit the project size and scope. This is the strong point of the course, since it teaches to think systemically. The course requires intuition and influences the way of thinking, these are hard things to master. The course requires a lot of "soft skills", such as communication, time management, deep self-reflection, etc.

**Analysis of Software Artifacts**

The original course is designed in such a way that it is relatively easy to get a minimum pass grade. However, it is a challenge to master the course. First, this is so because the course embraces quite a number of key concepts, laws, and techniques, and it is not easy to be good enough at all of them. Second, the course is focused at practical application of nearly all the techniques introduced (either through a Studio project or by practical assessments).

Thus, those who get best grades also acquire a passion for quality, which is vital for a software engineer. Thus, the material mastered in the course would help the students a lot in their future career. However, in order to master the above mentioned versatile concepts better, it makes sense to present a more detailed and systematic introduction of the above mentioned areas.

**Personal Software Process**

Many of the assignments depend upon initial level of student fluency in programming and individual performance, planning, and time management skills. The course guides, but it is not intended to instantly boost, individual development performance in each and every aspect. More achievements will happen in case the students keep improving their development processes and standards and following them. Every successful student is to get a feeling of high process quality, which is vital for a software engineer. Thus, the course material would bring discipline to the students' software development activities.
Conclusion

The paper outlines suggestions for tailoring the masters’ program in software engineering taught at Carnegie Mellon University to meet the requirements of the new and ambitious IT University project, Innopolis, which is underway in Russia.

The CMU MSIT/SE curricula courses (Analysis, Architecture and PSP) are tightly interwoven, and integrated with the practically-oriented Studio project. They are focused on quality and planning activities improvement to, probably, the best extent possible.

The curricula requires special training of primary instructors and/or teaching assistants in teaching excellence/proficiency. Thus, it is highly recommended to take an adjacent iCarnegie course named Teaching Excellence Professional (TEP).

References


Biography

Dr. Sergey V. Zykov was born in Moscow in 1971, M.Sc. in Computer Science from Moscow Engineering Physics University (MEPhI, Russia, 1994). He holds a PhD in Computer Science from MEPhI (2000, formal models and methods of ERP integration). He has a 20-year experience in IT, including 2 years as Vice-CIO of ITERA Group. He has a Certified Web Professional certificate in web design and e-commerce. He has a 20-year experience in teaching computer science and software engineering, and a mentor certificate from Carnegie Mellon University. He holds a PGCert in Higher Education from the London School of Economics. Currently, he is an Associate Professor of Higher School of Economics, Moscow Aviation Institute, Moscow Engineering Physics University, Moscow Institute of Physics Technology, and Innopolis University. He authored 10 books and over 100 papers on computer science and software engineering. Primary research fields: enterprise software development, enterprise application integration, data modeling, web portals.
The Use of Social Media Technologies as Novel Ways to Teach and to Promote Learning

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Abstract

The ubiquitous use of new information technologies, computer software and multimedia interfaces, particularly driven by the Internet technologies of the 21st century, has created opportunities for novel ways of teaching which promote learning. In the 21st century classroom or lecture theatre, teachers can no longer teach effectively through the application of the traditional individualistic or competitive learning models (Johnson & Johnson, 1978). Rather, what is needed is collaboration among students as well as between students and teachers. Internet driven collaboration is advantageous because it transcends spatial barriers and it creates opportunities for people to work in virtual workplaces (Jackson, 2002), and for students to learn together in peer learning networks (PLNs), which provide peer support and feedback in virtual classrooms (Howell, 2012) and thus enhance teaching and learning in novel ways. This paper is drawn from a study which investigated how selected social media technologies, namely Google+ Discussion Circles (GDCs) can be used to support teaching, learning and assessment for 2nd year, Bachelor of Education students, training to be teachers at a University in Australia. Data were collected from 145 students 60 of whom were enrolled in one face-to-face unit and the other 85 students were enrolled in the online, non-face-to-face mode in the same unit. The research found that the majority of participants felt mutually supported in the PLNs driven by GDCs and developed strong feelings of social connectedness as they completed their learning activities and assessment tasks. They valued their learning experiences and felt that this novel way of learning was more user-friendly than the lecture method, or the more conventional Learning Management System called Moodle, in promoting their learning.

Keywords: Novel ways of teaching, promoting learning, social media technologies, peer learning networks.

Introduction

The ubiquitous use of new information technologies, computer software and multimedia interfaces, particularly driven by the Internet technologies of the 21st century, has created opportunities for novel ways of teaching which promote learning. In the 21st century classroom or lecture theatre, teachers can no longer teach effectively through the application of the traditional indi-
vidualistic or competitive learning models (Johnson & Johnson, 1978). Rather, what is needed is collaboration among students as well as between students and teachers. Internet driven collaboration transcends spatial barriers as it creates opportunities for people to work in virtual workplaces (Jackson, 2002), and for students to learn together in peer learning networks (PLNs), which provide peer support and feedback in virtual classrooms (Howell, 2012) and thus enhance teaching and learning in novel ways. Yet the full potential of Internet driven technologies, particularly social media technologies, to support teaching, learning and assessment, is yet to be fully investigated. This paper describes the results of a quasi-experimental study involving two cohorts of 2nd year, Bachelor of Education students enrolled in a pre-service teachers award, who were given the opportunity to use Google +. Discussion Circles (GDCs) social media technologies to complete their learning and assessment tasks in the School of Education at a University in Australia. One cohort comprised on-campus, face-to-face students (n = 60) and the second (n = 85) was a fully on-line cohort, who received all their instruction and assessment via the Internet. The study was conducted in the second trimester in the 2014 academic year with the approval of the Human Research and Ethics Committee of the University and complied fully with all the ethical requirements.

Supporting Literature and Theoretical Framework

The relevant literature contains several theoretical frameworks, which lend support to the use of social media technologies to support and promote learning. For example, as outlined below, learning with the assistance of socially networked structures or peer learning networks (PLNs) is consistent with the foundational cognitivist theories of learning first proposed by Piaget (1923) and developed further by Vygotsky (1929) and Lewin’s (1948) work on group dynamics. It is also supported by the work of leaders in the field of instructional strategies such as Jerome Bruner (1966), Howard Gardner (1983), Spencer Kagan (1994), as well as supporters of eLearning including Ted McCain (2007), Don Tapscott (2009), Kelly et al., (2009) as well as Trilling and Fadel (2009).

Swiss psychologist Jean Piaget (1896 – 1980), to whom is attributed the cognitive developmental theory of learning, believed that individuals construct meaning of the world for themselves and accordingly, his four-stage theory became known as the epistemological theory of constructivist learning. Based on observations of children and adolescents whom he studied as they solved problems he set them in natural situations, Piaget (1954) concluded that learners construct new knowledge from their experiences. In a later book Piaget (1981) strongly argued that whatever gets into the mind of a learner has to be constructed by the learner through active knowledge discovery. So, Piaget’s cognitivist theory is undergirded by the understanding that learners construct meaning from their experiences gained as they interact with the environment. Virtual social networking broadens and enriches these interactions and can therefore enrich and promote learning. Thus, the use of social media technologies in pedagogy is informed by cognitive and social psychology as applied to learning based on PLNs. The PLNs comprise learners that cooperate in the exchange of ideas and views, which they share in peer-to-peer networks that are technologically enriched and driven by the Internet.

Moving the understanding of how people learn beyond Piaget’s (1954) work were the cognitivist theorists who developed an understanding that learning is a social experience rather than an individual one. They argued “the social occasions of conversation, discussion, joint work, groups, and debate play a critical role in learning” (Wilson et al., 2006, p. 4). As a result, they developed several theories of learning, which focused on the social aspects of learning and called them sociocultural theory, or activity theory or social constructivism for which the Russian cognitive psychologist Lev Vygotsky (1896 – 1934) became most famous and the foundational theorist for the pedagogical approach known as constructivism, (Vygotsky, 1929).
Vygotsky (1929) conducted intellectual development studies on the social environment of children and produced what became known as the developmental theory of social constructivism, whose key proposition was that children’s cognitive development is influenced most by interaction with people, especially parents, other children, teachers, and mentors in the child’s social environment. He argued that it is the collaborative interactions between a learner and members of his or her immediate society that enable the learner to make meaning of their world in their cultural setting (Vygotsky, 1978; 1981). He wrote: “In the process of development, the child not only masters the items of cultural experience but the habits and forms of cultural behaviour, the cultural methods of reasoning” (Vygotsky, 1929, p. 415). This understanding, that learners make meaning of their world through social interactions, adds impetus to the power of socially interconnected networks to promote learning. Another aspect of Vygotsky’s theory that is very relevant to the use of PLNs to learn is what he called the Zone of Proximal Development (ZPD). He explained the ZPD as the level of competence on a task in which a learner cannot yet master the task working by himself/herself but can complete the task successfully if given appropriate support by a more capable mentor. The significance of the the ZPD in PLNs is that the mentor who provides scaffolding, could be another student, providing guidance and feedback during the virtual interactions. It does not have to be a teacher. Herein lies the power of social media technologies to promote learning, beyond facilitation by the teacher or lecturer.

In his studies of group dynamics, German-American social psychologist Kurt Lewin (1890 – 1947) investigated how to resolve social conflict (Lewin, 1948) and his work also led to studies of how learning is influenced by cooperation and competition (Deutsch, 1949). Lewinian social-psychological theory became the basis for several cooperative strategies, which were made more popular in pedagogy later by scholars such as Johnson and Johnson (1991) and Dr. Spencer Kagan (1994) as will be discussed further below.

Like Vygotsky, Jerome Seymour Bruner (1966) also emphasized the importance of the constructivist principle of active learning. Bruner (1996, p.84) proposed that learning was a “participatory, proactive, communal, collaborative construction of meaning” rather than an individual pursuit of knowledge. It was this emphasis that led him to embrace what is popularly known as The 5E Instructional model and to apply it widely in educational contexts. Developed by biological scientist Bybee and his colleagues for the Biological Science Curriculum Study (BSCS) at Colorado Springs in the USA (Bybee et al., 2006a), The BSCS 5E Instructional model postulates that to maximize students’ active learning and construction of knowledge, we should give them opportunities to be involved in five key elements of constructivism, each beginning with the letter ‘E’, namely:

1. Engage
2. Explore
3. Explain
4. Elaborate; and,
5. Evaluate.

This 5E Instructional model is a learning cycle based on a constructivist view of learning, with each of the 5Es describing a phase of conceptual involvement, which seeks to maximize active learning, through coherence of teaching and learning strategies. Briefly, as explained by Bybee et al., (2006b), in the Engage element, students’ prior knowledge is accessed and their interest engaged in the phenomenon being studied, in Explore, students are given the opportunity to participate in an activity that facilitates conceptual change, in Explain, students generate an explanation of the phenomenon, in Elaborate, students' understanding of the phenomenon is challenged and deepened through new experiences, and in Evaluate, students assess their understanding of the phenomenon. This active learning is optimized when children are given opportunity to work to-
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going together in cooperative learning teams, such as PLN based GDCs, rather than on their own or in competitive structures.

Kagan asserts that “Cooperative learning promotes higher achievement than competitive and individualistic learning structures across all age levels, subjects areas, and almost all tasks” (Kagan, 1994, p. 3:1), thus lending support to the use of PLNs which are the nuclei of networked social media interactions. As Sherman (2001) rightly points out, the discipline of social and cognitive psychology advocates the use of cooperative learning strategies, which are the basis for technologically enriched peer learning networks. Artz and Newman (1990) explain that cooperative learning involves “small groups of learners working together as a team to solve a problem, complete a task, or accomplish a common goal” (p. 448). Cohen (1994) agrees when he says that cooperative learning is a teaching strategy that involves students working together in small teams where everyone participates in a clearly assigned task or role, and in so doing contributes to the learning of each member of the group and to all members in the group. Johnson and Johnson, explain that in cooperative learning, there is positive goal interdependence and individual accountability so that learners work together in small groups, with each making a contribution so that they “sink or swim together” (Johnson & Johnson, 2002, p.1). Cooperative learning is characterised by three important dimensions, namely, it is non-individualistic, it is non-competitive, and it is collaborative teamwork in nature. These characteristics are fulfilled through the five principles of cooperative learning which many leaders in the field including Kagan, (1994), Johnson and Johnson, (1991, 1994) Slavin, (1988), Stahl, (1997), and Metzke and Berghoff, (1999), in slightly different wording agree, are:

1. Positive interdependence
2. Individual accountability
3. Equal participation
4. Group processing; and,
5. Simultaneous Interaction.

It helps to unpack each of these principles briefly. Kagan (1994; 4:7) explains, “strong positive interdependence is created, if the success of each member depends on the success of every member. …students have the subjective experience of ‘being on the same side’ and will behave positively toward each other.” In explaining the principle of individual accountability, Harkins and Petty (1982), say that it means that no team member can enjoy a “free ride”. There is no “hitchhiking” or piggybacking”. Gillies and Boyle (2013, p.10) say that equal participation is enhanced when students provide each other with efficient and effective help and assistance, exchange needed resources to facilitate each other’s contribution, provide each other with feedback in order to improve each member’s contribution to the task, question and challenge each other’s conclusions, and advocate and encourage each other’s efforts to achieve mutual goals. The fourth principle, group processing, gives students the opportunity to reflect on learning experiences during teamwork, so they understand better what happened during the cooperative learning activities, to evaluate how they have achieved the set goals, and to discuss their overall experiences among themselves. Simultaneous interaction happens because, when students are organised into their cooperative learning teams, they are talking among themselves and working together all the time, and so within each team, there is simultaneous interaction among the students (Kagan, 1994).

The traditional approaches to instruction assume homogeneity in learning styles and we know from Howard Gardner (1983; 1999) that this is simply not the case. Giving students the opportunity to work in their own networks assumes and provides for heterogeneity among learners. This approach can therefore be said to be better suited to providing for the diversity and inclusivity of students. Moreover, students learn with each other at times of their own choosing that are convenient to them on a 24/7 basis. Siemens (2004) agrees when he proposes the connectivist paradigm
to extend an understanding of how learning occurs beyond the traditional behaviourist, cognitivist and constructivist paradigms, discussed above. The connectivist paradigm proposes that the construction of knowledge includes learning by individuals, machines, groups, organizations as well as other systems (Siemens, 2006). Siemens (2006) explains that in the connectivist paradigm, we have a new technological society in which know-how and know-what are being supplemented with know-where to find the knowledge that is required to make sense of a given situation. The use of PLNs gives students opportunities to work in Internet based connections which enable students to utilise the connectivist paradigm not only to know-how and know-what but also to know-where by individually taking the initiative to search for information and then sharing it asynchronously with members of their PLN.

This sharing through PLNs is supported by Howell (2012) who directly advocates a collaborative epistemology in which learning is facilitated and amplified through collaborative activities using social media technologies. She argues that learning takes place, not through data bases, but through social interactions connected through the Internet. She presents the understanding that social media are used not just for social conversation but for active learning of pedagogical content and for completing formative assessment in collaborative Peer Learning Networks (PLNs).

Trilling and Fadel (2009) say that working in teams, scattered around the globe and connected by technology are becoming the norm for 21st century work. Thus, the advent of technology in a global village means that students will grow up and work increasingly through interactions with other people rather than individualistically. Teaching them using social media in PLNs helps to prepare them for more pro-social learning and working environments. In those environments, the information economy will be driven by the ability to share knowledge with others rather than simply having the know how; and by ability to work cooperatively not just competitively.

This is not to say that the use of social media in teaching and learning has not been questioned. Some theoretical perspectives which have questioned the use of computer-mediated social interactions for learning have cited what they have called deindividuation of people and behavioral disinhibition among participants in cyberspace during virtual interactions (Zimbardo, 1969). They have argued that deindividuation occurs in such interactions because they involve many people communicating anonymously, with non-identifiable virtual genders (Burn, 1996), with intense task absorption, and little self-focus (Joinson, 1998). Those proposing the disinhibition argument have suggested that people engaged in cyberspace conversations become less inhibited in disclosing information about themselves. However, other scholars (such as Postmes & Spears, 1998) have argued that the deindividuation hypothesis lacks empirical evidence. Similarly, (Jazwinski, 2001) dismisses the disinhibition proposal.

Other critics of the quality of conversations conducted in virtual social networks have argued that it is bound to be poor because it lacks the nonverbal cues, appearances, body language and contextual vibes that guide social interactions in normal, face-to-face dialogue (Sproull & Kiesler, 1991). However, studies by Weisbad, Schneider and Connolly (1995) found no significant difference between face-to-face communication and computer-mediated social interaction, thus dismissing the Sproull and Kiesler argument.

What emerges from this literature review is a strong theoretical framework in support of the use of social media technologies to support teaching, learning and assessment by providing students opportunities to learn together in cooperative rather than competitive or individualistic structures which are less conducive to engagement, higher-order learning and overall knowledge construction. Thus it would appear that the use of social media in pedagogy is fully consistent with the theories of learning advanced by leaders in the field discussed in this section. The theories provide consensus that children learn best when they are given opportunities to co-construct knowledge through social interactions. They learn better through social interactions than they would
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learn on their own. As Mercer (1995) asserts, since the 1970s there has been increased understanding that children learn readily when they are given opportunities to collaborate and communicate with their peers, parents, siblings and caregivers. Similarly Toohey (2000), admonishes that “learning must be understood as a process embedded in social relationships and cultural practices, a situated practice within a community of learners rather than a process of individual acquisition transmitted by an expert” (p. 79). Additionally, as proposed by Prensky (2001), Kelly et al., (2009), and Tapscott (2009), social media are the most preferred means of communication among young people in our classrooms today. Thus, the theoretical and research evidence available suggests that it is prudent to maximise the use of social media technologies in pedagogy as a way of striking congruence between the language and platform used by educators to deliver instruction and by learners to engage with that instruction.

Methodology

Research Question

The research was undertaken to answer one overarching question with four subsidiary questions. The questions were stated as follows:

1. How does the use of selected social media technologies, namely Google +. Discussion Circles, (GDCs), support teaching, learning and assessment? The subsidiary questions were:
   i. How does the use of GDCs influence students’ levels of participation, engagement, exploration, elaboration, explanation and evaluation? (Bruner’s 5E Model).
   ii. Are there noticeable differences in the level of student engagement with learning and assessment activities, depending on whether the students are using GDCs or not?
   iii. What is the nature of content that students share while engaged in learning and assessment activities, using GDCs?
   iv. What does the nature of the contents in the GDC streams reveal about students’ interest, motivation and collaborative peer mentoring while engaged in learning and assessment activities using GDCs social media technologies?

Research Design

To investigate the above questions the research was designed as a quasi-experimental case study utilizing mixed methods to gather and analyze the data. The case was bounded (Smith, 1978), to consist of students enrolled in two cohorts of a 2nd year Bachelor of Education Unit in the second trimester of 2014 at a University in Australia. One cohort was internal and the other external. This design was consistent with Yin’s (1994), definition that the “case study is an empirical inquiry that investigates a contemporary phenomenon within its real-life context, especially when the boundaries between phenomenon and context are not clearly evident” (p. 14). As Merriam (2001) admonishes, “the case could be a person such as a student, a teacher, a principal; a program; a group such as a class” (p. 27). The participants in each of these two groups (the internal and external cohorts), are discussed further in the next subsection.

The quasi-experimental design was chosen as the most appropriate because it would not have been possible to apply randomization procedures and have one set of students as a random experimental group and another as the control group to have a true experimental design (Burns, 2000). However, following Keeves (1997) and Denzin and Lincoln (2000), the closest to an experimental design that was possible, was to have both the internal and external cohorts of students
conduct their learning and assessment activities in practically identical ways, except that the external cohort utilized GDCs whereas the internal cohort did not. Both the internal and external cohorts enrolled in this Unit use the University’s learning management system called Moodle. Both cohorts receive the same lecture notes every week. However, while the internal cohort receive theirs in both the face-to-face mode and online, the external students get theirs delivered through a communicative software called Camtasia Relay, which delivers not only the PowerPoint of the notes but also the audios, videos and graphics that are presented in the lecture. The internal students can also access the Camtasia folder if they wish. The lecture is delivered early Monday morning but the lecture notes are available to both cohorts, online 24/7 following each lecture. Each lecture is followed by a series of activities given to all students to help them engage further with the contents of the lecture, and prepare for the various assessment tasks. However, while the internal cohort also have a weekly face-to-face tutorial in which they discuss the topic for the week, the external cohort do not have this opportunity. Instead, they discuss the topic in two ways. First, they do so in Forums in Moodle. Secondly, they form PLNs within which they discuss the topic using GDCs. Both the internal and external cohorts are encouraged to participate in the Forum discussions in Moodle, and to set up GDCs if they wish. Participation in the Moodle Forums is mandated, and monitored by the lecturer; but engagement in the GDCs is voluntary, and by mutual invitation. This includes the lecturer.

The mixed methods approach enabled the sub-research questions to be investigated and answered through a qualitative or a quantitative analysis of the data. This paper reports the findings in answer only to sub-research question 1, as it would not be practical to discuss the findings of all the four sub-research questions in one paper. Questions 2 – 4 will be the subject of future publications.

Participants, Sample Size and Sampling Procedure

As stated earlier, the study involved two cohorts of students, an internal cohort (n = 60) students and an external cohort (n = 85) giving a total population of 145 participants (n = 145) in the Unit in the second trimester of 2014. The trimester ran from the end of June 2014 to the end of October 2014. Whereas the trimester ran for 13 weeks, participation in the study involved only 9 weeks because students were out on professional practice in different schools for four weeks. During those four weeks they were not required or expected to participate in the study. They were also not expected to participate during two weeks of the mid-trimester break in August.

For the internal cohort, students work in tutorial groups of no more than six. Each tutorial normally follows a jigsaw cooperative learning structure (Kagan, 1994), in which the workshop starts as a whole-class before they break up into individual groups; and then back into a whole-class structure for demonstration of teaching strategies that they are learning. The internal cohort are introduced to the use of GDCs and encouraged to work with them if they wish. For the external cohort, their PLN has a core of ten members. Starting from this nucleus, they are free to invite anyone they want to join their PLN using GDCs. The invited participants can be from any other group in the Unit, from another Unit altogether, from a different faculty or even from another university; or for that matter, not even a student at all. The criteria governing participation are that a) the invited participant must limit their contribution to matters relevant to the pedagogical topic being discussed in the PLN, b) they must not post in the stream of the GDC anything derogatory or offensive, and, c) there must be no ‘put-downs’. I monitor what happens in the GDCs and if need arose, I could block any participant from seeing what goes on in any of the circles, if they contravened any of these conditions. However, over the three years that I have taught using GDCs, there has not been a single infringement. For the external cohort, the participation in the GDCs is seen as a substitute for the face-to-face tutorials held by the internal cohort. But, as I said
earlier, students in the internal cohort are also free to engage in GDCs if they wish and are in fact encouraged to do so.

**Sampling procedures**
The internal cohort were asked to form groups ranging in size \( n = 4 - 6 \). These groups were treated as random samples, as any student could join any group, and they were in fact encouraged to do so. On this basis, the internal cohort created eleven samples with \( n \) values ranging between 5 – 6. There were only 6 male students in this cohort. These randomly assigned themselves to different samples, without influence of the lecturer.

The external cohort (\( n = 85 \)) were asked, first to form a random group of 10 in Moodle, and then use that sample as the basis for building a PLN using GDCs. There was no limit on potential participants in any of the PLNs. The PLNs were purposely designed like this, to allow for maximum participants and interactions among PLNs utilizing the dynamics of social media – the GDCs. Participation in any GDC was by mutual and reciprocal invitation. This means that a participant in a PLN initiates a GDC and invites others into their Circle. The invited participants respond through a similar process. This design made GDCs preferred over Facebook because it gave all participants greater control of whom they interacted with in cyberspace. Also, in posting into the stream of each GDC, participants were urged to always make sure that they chose the ‘Share in Private’ option rather than ‘Share Publicly’.

**Ethical Considerations**
The researcher sought permission to conduct this study from the Human Research and Ethics Committee of the University at which this study was conducted. Permission was granted under Licence Number HREC-HE14-2014. This License stipulated several conditions which had to be met including that the names or identities of the participants were not to be identified. For this reason, the data presented in the next section deliberately blurs or blots out the photo images of the participants so that their identities are protected. Furthermore, students in both cohorts were given exactly the same opportunities, so that no student was disadvantaged.

**Information to participants and participant consent**
Students were informed of the study and its purpose through an announcement in Moodle. Detailed information was given in a special page posted in Moodle. Students were invited to participate in the study using GDCs, and it was made clear that participation was entirely voluntary, and that if they chose not to participate in the GDC, they would not be subjected to any disadvantage. They were to give consent by opening a Google account and sharing their email address with their peers.

**Limitations to the study**
The study could not have one of the cohorts as a control group and so relied on students’ utilisation of GDCs as the distinguishing feature between the two cohorts. As the internal cohort did not use GDCs, this enabled the study to make comparisons of students’ participation and engagement in the activities. Data were gathered only over a period of nine weeks because the trimester has four weeks of professional practice when students could not be expected to participate in GDC activities. Participants were not required to post a specified number of comments in the GDC streams. This meant that some students could be very active, while others could participate rather infrequently.
Data Gathering and Analysis

The data comprises the postings made into the GDC streams, including whatever resources the students embedded into the GDCs stream from whatever sources they wanted. These included resources from texts on pedagogy, teaching strategies, YouTube, and their own creations, such as photographs and graphic organisers. The analysis started by simply observing the posts in the GDCs, reading them, and making sense of the contents in the GDC stream. This enabled an analysis of frequency of posts, variety of posts, content in the posts, demonstrated interest, levels of participation, engagement, exploration of ideas, elaboration on what had been posted, explanation of what was posted and evaluation of others’ contributions.

Results

Because the data gathering process has just been completed, the results available for discussion in this paper relate only to sub-research question number 1. As said earlier, the answers to the other research questions will be discussed in future publications. The research found that when students were given the opportunity to learn using GDCs, the majority took advantage of the social and structural dynamics created by these technologies in many ways that supported their learning and assessment activities. The evidence shows that the benefits included increased participation, greater interaction within each PLN, richer posts in the GDC streams, greater peer mentoring, greater engagement, exploration of issues, elaboration of what was being discussed, evaluation and explanation consistent with Bruner’s (1966) 5E Instructional model for supporting and maximizing students’ learning. The evidence encourages universities and other higher education providers to explore opportunities for utilizing selected social media technologies, such as GDCs, in pedagogy, as a novel way to promote active learning.

Level of Participation

A very interesting observation was the extent to which students took initiative not only to set up their own GDCs, but to also invite their peers, from outside their own PLN to contribute to the discussions for the week in their GDC. Although there was a great divergence in the level of participation, it was clear that every PLN enjoyed a multiplier factor among its participants. This varied from a low multiplier effect of 160% for the PLNCK5, to a high multiplier effect of 460% in PLNCK1. These results are illustrated in Figures 1, and 2 respectively.

![Figure 1: Level of participation by students in the GDC for PLNCK5](image)
This multiplier factor is very significant when the participation in the PLNs driven by GDCs is compared to that in the groups that relied on Forums in Moodle. Whereas the Moodle groups remained constant at 6 – 10 students in a group, those in the PLNs used GDCs to amplify their membership and participation. Students said that they felt a lot of mutual support for each other, through the increase in participation.

Level of Engagement and Exploration

An analysis of how often individual students visited and revisited the GDCs to make a post in the stream showed that students made several visits each week to participate in the GDC discussions. What’s more, the posts were conceptually deep and extensive in discussing the points raised in the stream. The high frequency of posts in the stream and the extensive nature of the discussion was interpreted to indicate a high level of engagement and exploration of the topics that were being discussed. Consistent with the ‘Elaboration’ element of Bruner’s 5E Model (Bybee et al., 2006a; 2006b), students made comments which showed that they were using their prior knowledge or information that their peers had posted in the GDC stream to generate new ideas, explore additional questions and possibilities, and offer additional ideas for discussion. They expressed strong feelings of connectedness as they explained and explored further, the posts made by their peers in the GDC streams.

Level of Interest, Motivation, Explanation and Elaboration

According to Bruner’s 5E Instructional Model, in the ‘Explanation’ element of the model, “The explanation phase focuses students’ attention on a particular aspect of their engagement and exploration experiences and provides opportunities to demonstrate their conceptual understanding, process skills, or behaviors. This phase also provides opportunities for teachers to directly introduce a concept, process, or skill. Learners explain their understanding of the concept.” (Bybee et al., 2006b, p. 2). These learning attributes were very evident in the posts in the GDCs. Students’ posts demonstrated their grasp of the topics being discussed and their response to the posts demonstrated their conceptual understanding of the issues raised. New concepts were introduced by the lecturer each week; and additionally as students engaged with and elaborated upon the points raised. The frequent use by students, of graphic organizers to summarise their understanding and
the posting of photos and Youtube video clips into the GDC streams were further evidence of interest, explanation and elaboration by the students, and that they valued their experiences in the GDCs, which they found more user-friendly than Moodle Forums.

Conclusion

The results appear to support the hypothesis that learners in the 21st century, digital age, communicate mostly using digital technologies, particularly social media technologies, including GDCs. For example, we know from the work of leading scholars into how children of the present generation learn, such as Prensky (2001), Jukes, McCain and Crockett, (2010) that “children of the 21st century – the digital generation, ... spend most of their time texting people on their cell phones, chatting with friends using instant messaging, interacting with people on Facebook or MySpace, playing games on Xbox or Wii and surfing the Internet” (Jukes, et al., 2010, p. 20). It therefore makes a lot of sense for pedagogues to communicate with their students using the media that the students prefer. What’s more, leaders in pedagogy such as, Vygotsky (1962), and Bruner (1966) tell us that children learn best if they are given opportunity to actively engage with the activities in the learning process and in figuring out what those activities mean to them. This is the essence of the constructivist paradigm that is the cornerstone of our pedagogical practice today. The use of GDCs in teaching, learning and assessment can be very engaging as students can work within the GDCs to extend their own understanding, to question that of their peers and to challenge their peers to engage in critical thinking and active imagination as they contribute to the GDC stream.

As indicated above, students frequently posted photos and used graphic organisers to summarise their contributions to the GDC streams. We know from the extensive work of Howard Gardner (1983) that ability to see form, shape, colour, and texture in the “mind’s eye” helps the learner to transfer these images to concrete representations which facilitate understanding and construction of new knowledge. As Chapman (1999, p. 107) explains, “The way one sees the world in the “mind’s eye” is that personal view of the world as pictured in one’s mind. Thus, the students were able to offer each other a window into the “mind’s” eye and thereby facilitate critical thinking within their PLNs. Moreover, students whose learning style prefers visual representations could capitalise on their strength using spatial learning techniques like the photos, graphic organisers, and YouTube video clips that the students posted in the GDC streams.

In our understanding of how children learn and therefore how we should teach and assess their learning, we are guided by the foundational theories of Piaget (1896 - 1980), Vygotsky (1896 - 1934), Bruner (1915-), Skinner (1904-1990), Edward de Bono (1933-) Bloom (1913 - 1999) and Gardner (1943-). The consensus from these theories is that children learn better through interaction with others than on their own. The use of GDCs creates opportunity for students to maximise these interactions and experiences.

In consideration of the findings of this study I argue that the old, traditional approaches to education and teaching that do not utilise digital tools are no longer adequate for teachers of digital children, who thrive on social media, and study in classroom environments driven by information technology. Therefore, as the world becomes increasingly more and more interconnected, pedagogues need to make sure that they are well equipped with eLearning and eTeaching technologies, including the use of social media technologies, such as GDCs. I believe that if properly embedded in pedagogy and curriculum, social media technologies have great potential to provide for social learning (Piaget, 1923), and co-construction of knowledge (Vygotsky, 1978). They are very engaging and exploratory (Bruner, 1966) in nature and encourage children to approach learning from different perspectives (De Bono, 1956), which helps them to learn from their peers by applying knowledge (Bloom, 1956) and in their own way (Gardner, 1999, Skinner, 1953).
Social Media Technologies as Novel Ways to Teach and to Promote Learning

References


Social Media Technologies as Novel Ways to Teach and to Promote Learning


**Biography**

**Dr. Charles Kivunja** is a Senior Lecturer in Leadership and Pedagogy in the School of Education at the University of New England, Australia, where he won the Award for Excellence in Teaching in 2009 and the Excellence in Unit Development Award in 2012. He gained his PhD in Leadership and Pedagogy from the University of Western Sydney-Australia. He holds three Masters degrees in Economics and Management one from each of the University of Sydney, University of Western Sydney and the University of Nairobi. His first degree, earned from Makerere University in his mother country Uganda, was a Bachelor of Economics with Honours and a Diploma in Education. His research interests include the use of social media technologies in teaching, learning and assessment, and multigrade pedagogy, and he has published in International Journals and as well presented at International Conferences on topics in these areas.
Strategies, Practices and Skills for Competitiveness in the Digital Economy: A Perspective on Large Companies in South Africa

[Abstract Only]

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Abstract

Against a changing paradigm towards a progressively digitalised economy and an increasingly digitally infused society, South Africa is reported to lag behind in terms of its digital readiness. However, the business sector is a critical role player in unlocking the opportunities posed by the digital economy and has, according to the WEF report, taken the lead: 30th out of 148 countries. Despite such international studies that give South African businesses a reasonably fair rating in aspects such as setting trends and thinking about future practices, little more is available on how South African companies are responding to the opportunities and challenges posed by the digital economy. Against this background, the University of the Western Cape, the University of Stellenbosch Business School and iNeSI undertook a collaborative research project to: (i) understand, discover and learn more about the progress the South African business sector has made as a potential trend-setter in the quest for digital readiness by the country.

Eighty-two large companies, across the various sectors participated in the study and the results are discussed under six themes

Keywords: digital economy, South Africa, competitiveness, digital readiness, e-skills
Using the New Media to Improve Student Performance in Secondary Schools

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Abstract

In the corporate world, with its international, competitive environment, many firms have become learning organizations in order to survive and thrive. Similarly, these days secondary schools that succeed will lean, flexible, and nimble as Drucker (2005) argued that “once asserted that in the not-so –distant future” high schools will be remnant” and will not survive. This paper explains how grade eight students from five purposively selected secondary schools in Limpopo rural area as well as teachers can use the new media (e.g. compujector) technologies to enhance both teaching and learning abilities. Findings shows that over (57%) learners thought that science and maths subject were difficult while (42%) thought these school subjects were ’moderately manageable’ and (59%) believed schools are irrelevant and not helpful by ignoring teaching technology in schools as they fall behind to their counterparts in city schools private schools.

Keywords: learning organizations, students, obsolescence, high school teaching, high teachers
Technology Acceptance and Disadvantaged Students – The Role of Culture

[Abstract Only]

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Abstract

The overwhelming majority of students entering University of Limpopo in South Africa come from a homogenous cultural background and have not had any exposure to ICTs (computers). This study examined the level of such students’ ICT use and the extent that it was influenced by their cultural background. It then examined the instances where academic performance could be attributed to ICT use.

While the role of technology was clearly found to be of vital importance, its impact on academic performance was manifested only when ICT use is encouraged through academic programs. In particular, the use of the Internet, email and online search were found to influence academic performance when encouraged by the academic community. The study showed that a key source for the high level of interest in technology came from students’ cultural background.

Keywords: Technology, culture, disadvantaged students, academic performance
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Technology Access Centres and Community Development: Selected Cases from the Eastern Cape and Gauteng Provinces in South Africa

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Abstract

The World Bank has in the past reported a 70 per cent failure rate of their information and communication (ICT) for Development (ICT4D) projects in many countries that they establish ICT projects at (Leung, 2013). South Africa as well has several examples of failed ICT4D projects of centres (Benjamin, 2003), especially during the first 10 years of the democratic dispensation (1994-2004). However, the second decade of democracy (2004 to 2014) has experienced better performance by ICT centres and better attempts at using ICT for community development. During this last decade, South Africans, stirred by the reality of the first failed telecentres, changed tactics and development strategies in processes of implementing ICT4D. These technology access centres, also known as e-centres, are now establishing for teaching citizens problem-focused ICT skills to address socio-economic challenges such as unemployment, illiteracy, and poverty. E-centres focus on education and health initiatives. This article describes two successful and one failed ICT4D projects that these two researchers conducted research on from 2012 to 2013, in a study that researched a few ICT centres in four South African Provinces (viz., the Eastern Cape, KwaZulu-Natal, Western Cape and Gauteng). This paper, however, provides details of ICT4D centres located in the Eastern Cape Province as data from all four provinces is vast and is best reported in a few publications, for recording and comparative reasons. Data were collected through personal interviews of persons using the ICT centres and also semiotic analysis of selected online videos on the ICT centres for elaborate information about the centre due to the fact that not many centre users were found at the centres by the researchers during site visits. Thematic analysis was implemented to analyze collected data.

Keywords: Technology access centres, digital inclusion, e-education, public-private partnerships, community development

Introduction

It is well recorded that ICTs have vast possibilities for educational and economic development. ICTs broadly include technologies that “capture, store, process, transmit and display information by electronic means” (Rao, 2009, p. 3). E-skills are taught by governments to citizens in many countries of the world and are internationally spread through forums such as the World Summit for the Information Soci-
ety/WSIS (2005). In 2005, the WSIS, encouraging countries to empower their citizens with computer literacy and e-skills enabling people to function efficiently in information societies, defined e-skills as computer and Internet skills useful to ‘empower individuals so that they can participate fully as citizens of the information society, and take advantage of all the opportunities before them; opportunities for employment and wealth creation, innovative education and learning strategies, and for using new life-enhancing services, such as interaction with public authorities’.

A wealth of research has been carried out since the 1960s into the role of computer technology in teaching and learning (Kuang-wu Lee & Chuang, 2000). In school systems as well as in community organizations in the Western world and in developing countries, the use of computers for different purposes in the classroom, multipurpose community centres (MPCCs) is widespread and this trend is on the rise in developing countries (Rahimpour, 2011). In South Africa, MPCCs have evolved since the mid-1990s, while e-community centres have evolved from around 2009. With the advent of an ever-increasing variety of educational multimedia software; with the various possibilities offered by telematics and above all, with the Internet, there is a growing interest in developing ways of incorporating these "new" technologies into the school curriculum so that teachers and their students may exploit their potential to the fullest. Additionally, there is an increasing preoccupation with the role that these technologies can play in education outside formal settings – e.g., in e-community forums and MPCCs - within the community at large, for open and lifelong learning (Lesame, 2009). Technology is also used to establish links between formal and non-formal sectors can be developed and strengthened, breaking down traditional barriers to communication and the sharing of information resources. Government alone cannot perform the function of building e-centres and educating the nation (Hamid, 2010). Therefore, government started working with the private sector around 2009 in this quest to spread e-centres nationally for educational purposes. A prerequisite for success and sustainability of such centres is the use a collaborative approach in which the community participates fully in all stages and parts of an ICT project (Marshall & Taylor, 2005). This ICT collaboration model development model is also advanced in South Africa, for example, at Siyafunda Community Technology Centre (SCTC) in Palm Ridge, Gauteng Province (Ismael, 2013). The collaboration is between government, the private sector, municipalities, civil society organisations and other interested funders and parties collaborate to establish and operate ICT centres for the development of areas previously (i.e., before democratic rule) without ICT infrastructure and services. Some of the partners making Siyafunda CTC successful are depicted in Figure 1.

Figure 1: Public-Private Partnerships Sustaining the Palm Ridge CTC
Source: Ishmael (2014); Graphic re-created by Wigston (2014)
Siyafunda (which, in English means “we are learning”) CTC also has advantages of enjoying community support, having a positive ICT champion (Ishmael, 2013) and very supportive ICT trainers who ensure that ICT skills are imparted to community members and also initiate collaborative efforts with other stakeholders with the main aim of serving the developmental needs of community members. It is, therefore, important for e-centre leaders to possess social capital, and in Ishmael’s (2014) view, to promote “social entrepreneurship”, which means that while there is a critical need to pursue business interests in communities, ICT leaders should pursue such business interests but also promote community development goals in the process of self-improvement. Social consciousness therefore cannot be distanced from self-development. Some positive development lessons learned from the success of Siyafunda CTC in Palm Ridge are stated in Figure 2.

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<th>CRITICAL SUCCESS FACTORS FOR E-COMMUNITY CENTRES</th>
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<td>1) “Work with the community to assess information needs and communication;</td>
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<tr>
<td>2) Carry out awareness campaigns on the potential benefits of the Internet; ensure that key community leaders are involved in campaigns disclosure because they know what the most appropriate channel to reach the community (at the same time also become familiar with the benefits of the Internet);</td>
</tr>
<tr>
<td>3) Obtain local government and NGO support and commitment to the project. Regarding the case studies focused on in this article, in the Palm Ridge Siyafunda centre, cooperation with local government and NGOs is quite evident as the centre works with the Ekurhuleni municipality and the centre was opened by Ekurhuleni Mayor Duma Nkosi in 2007 and the centre has been supported by the municipality in many different ways since then. There are also several NGOs working with this centre, from local community groups to computer recycling companies with refurbish the centre’s damaged computers to new ones. With regards to the Cofimvaba MPCC, the centre works with the Cofimvaba Local Municipality and is even located inside the municipal building and therefore the centre saves on electricity, rental and related costs because these remain the responsibility of the municipality. The Dwesa Siyafunda centre also works with the Port St. Johns municipality, especially regarding farming issues such as fishing rights and other business initiatives pursued by women (for example catering businesses). So in all, all the succeeding e-centres enjoy different forms of support from local municipalities and this is required or critical for any centre to survive and centre leaders are advised to seek this support and after obtaining it, to ensure that it grows and is sustained in positive ways.</td>
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<td>4) Identify and support local champions; these champions are community leaders which assist centre leaders to communicate with community members about any issues that need community understanding and support;</td>
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<td>5) Involve the community in the design, implementation and management of the centre;</td>
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<td>6) Ensure that the community is willing to strive to maintain the centre operation for long term;</td>
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<td>7) Ensure participation of all community representatives in centre activities, for example women, youth and the disabled individuals;</td>
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<td>8) Provide training in information technology and telecommunications by providing technical support and e-skills;</td>
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9) Ensure the provision and maintenance of progressive resources, i.e. knowledge and skills that community members make use of on a daily basis – these could include education information, e-banking facilities, online job facilities, learnership programs with government departments and the private sector, and related social services aimed at improved the lives of individuals;

10) Provide continuous technical assistance services, systems maintenance and upgrading of hardware and software;

11) Ensure that local community consultation in relation to the financial infrastructure centre and obtain the commitment of the same, for example fees, ownership of hardware, salaries of centre managers and ICT trainers; and

12) Establish partnerships with local businesses, educational institutions and providers Internet services”. The successful e-centres mentioned in this article, Dwesa Siyafunda and Palm Ridge Siyafunda have established and strong working relationships and Rhodes and Fort Hare Universities (Dwesa) and the University of Johannesburg and Cisco Academy (Palm Ridge) to advance educational programs offered by the centres. These relationships sustain a centre educationally, technologically and financially.

Source: Ishmael (2014)

Figure 2: Critical Success Factors of the Palm Ridge Siyafunda CTC in Gauteng Province

Technology may be introduced into the education sector at any level of the system, from pre-primary to tertiary, in the non-formal as well as the formal sector. These technologies may be used as tools for aiding in the management and administration of the system or may be introduced into the e-skills curriculum, either specifically as subjects of study, for example where microcomputers are used to teach students basic computer awareness or programming, or as tools to improve the teaching-learning process in relation to other subjects in the curriculum. Where ICTs are fully integrated into the school or MPCC system, they may be used for all three purposes. Some experiences have shown the use of computers in teaching to motivate slow learners or "at risk" students as well teach e-skills to unemployed school leavers to enable them to find employment after completing an e-skills course at an e-community forum or a Thusong Service Centre (TSC) rather than at tertiary institutions that most economically deprived South Africans cannot afford to pay for.

Literature Review

Any study requires a sound theoretical foundation which will assist in analyzing and interpreting the gathered data, among others reasons. Theories forming the basis of this study explain how ICTs are used by members of communities. The research is located within the field of community informatics (CI), a theoretical approach that explains how innovations are adopted and used by individuals, especially those unfamiliar with the technology (Gurnstein, 2000a, 2000b; Harris, 2001). Other theories relevant for laying a sound foundation for this study are the technophilic and technophobic approaches to the study of the role of ICT in development (Lesame, 2009). The technophilic or utopian school of thought explains the positive ICT role in development and is pro-development, supports the deployment of ICT in communities and associates positive developments with this deployment. This perspective espouses the view that in the economy, ICT expands productivity and improve employment opportunities, and upgrade the quality of work in many occupations. Moreover, ICT offers many opportunities for small-scale, independent and decentralised forms of production. Regarding developing countries, technophiles envision that technology will aid countries to leapfrog stages of development (Matsepe-Casaburri, 2002).
As much as there are optimists about the role of ICT in development, there are also pessimists that view ICT as not contributing positively to development. Known as technophobes, these thinkers regard ICT as having a negative effect on development and contributing towards the expansion of the rich-poor information gap, the literate and the illiterate. Results of this study indicate more optimistic or technophilic results of how ICT has developed two rural Eastern Cape communities (Dwesa village and the town of Cofimvaba), while the results from another town (Cradock), indicate that ICT has not touched the lives of people which the ICT centre was established towards developing, which could be interpreted as a technophobic stance towards technology adoption and use.

There is much literature published in other countries on the role of ICTs in teaching and learning at community ICT training centres and schools (Marshall & Taylor, 2005; Musiyandaka, Ranga & Kiwa, 2013), but this kind of information and knowledge is not abundant in South Africa. This study contributes towards increasing existing knowledge in this area of study. Dwesa village has been researched by a few ICT enthusiasts before (some mentioned in this article), but the Cofimvaba and Cradock ICT centres have not been researched and written about, so this study fills that information void.

**Role of Technology in Learning and E-Skilling**

Technology was originally intended to serve as a means of improving efficiency in the educational process (Jones & Knezek, 1993). “Nowadays the role of information and communication technology (ICT), especially the internet in the education sector plays an important role, especially in the process of empowering the technology into the educational activities” (Kaka, 2008:1). Technology such as the internet can be the most effective way to increase the student’s knowledge, more especially if used productively. Literature in the United States, Australia and some Asian countries has established that the teacher or ICT trainer should be the main motivator and initiator of ICT implementation at schools (and, by implication, at any other community centres where e-skills are taught) (Kaka, 2008). ICT trainers or those imparting e-skills to other persons should be aware that they are shapers of social change and future leaders, and should therefore be willing to introduce ICT in teaching and learning activities to impart more knowledge to those being taught e-skills. E-skill trainers should be agents of change from old teaching methods dominated by face-to-face, paper and pen, as well as blackboard communication to modern forms of teaching where technology such as the internet, mobile phones, social media, wikis and others is used to assist learners to gather, share, produce and transmit information.

The past decade has seen the rise of alternative methods of education and social support involving ICT interfaces, which include electronic mail (email), instant messaging (IM), text messaging or short message service (SMS), Web pages, social media and so on. Social support is an integral part of education and student life and ICTs have also been found to offer learners both education and social support necessary to live full fruitful lives. In the study of the role of ICTs in education and social support, Eden and Heiman (2011) found that ICT offers students support, encourage more interaction between students which might evoke more proactive coping strategies, that instant messaging is more useful for receiving social support and email is more useful for practical social and education advice.

**Community Informatics**

Community Informatics (CI) is employed in this paper to identify technology available at the centres as well as ICT service providers supporting the e-centres in one way or another. The CI theory is also executed to assist in identifying ICT users and e-skills taught at the selected e-information centres for different educational and economic purposes and contexts. In principle, CI theory explains how ICT is adopted and employed by technology users, especially those users
unfamiliar with the technology (Gurnstein, 2000a; Harris, 2001). “The study of community informatics (CI) is emerging in part in response to the challenge of achieving economic and social development for communities through the use of ICT, and pays attention to physical communities and implementation of technologies and applications, which enhance and promote their objectives” (Harris, 1999:74). Furthermore, Gurnstein (2000b) states that CI begins with ICT, as providing resources and tools that communities and their members can use for local economic, cultural and civic development, and community health and environmental initiatives. As a theoretical framework, CI also includes the ICT and the “user” (in this case teachers, school children and other users at the selected schools and TSCs) and the “uses” to which they put ICT.

In this study, CI was applied in the research methodology part through questions asked in personal interviews, asking those teachers, TSC managers and ICT trainers teaching e-skills and those receiving e-skilling about technologies they use for what educational activities, including hardware and software. Questions about the role impact of the ICT on the learner’s education, which fall within the CI realm, were also asked. All these questions therefore, locate this study within the CI field. Fundamental to the advancement of personal education or social and economic development through ICT usage, is access to ICT. Gurnstein (2000b, 3), identifies an “ICT Access Rainbow” with discrete levels, which creates the required environment in which access to ICT can be provided or even achieved. These levels are:

a) **governance and policy** – which identifies who manages the centres, and promotes cooperation between different stakeholders to establish and operate a community ICT centre. In this regard, Marshall and Taylor (2005) state that the social inclusion approach that is fundamental to a community informatics system (CIS) approach is based on principles of **participation**, **self-actualisation** and **individual responsibilities** to the rest of the community. In South African communities these principles, and also the social inclusion approach to community development is practiced through local meetings called **iimbizo**, where all community members are invited to voice out their views about the processes and centres envisaged;

b) **literacy and social facilitation** – this happens in schools and other educational institutions and TSCs;

c) **service providers** – are critical in ICT service provision to ensure that community members have access to ICT and information;

d) **content and services** – this factor is critical in aspects of community development as it aims to promote the relevance of ICT centres to local problems and also the creation of local content in local languages that local people speak, understand and write. In a study on challenges facing women using ICT in the Eastern Cape, Chisango (2013) states that local languages should be used to develop new TSC content as most local women in that province do not speak or understand English and prefer ICT content that is written in their own language, **Xhosa**;

e) **software tools** – become necessary especially where new local content has to be developed for use local TSC users; and

f) **devices and carriage facilities**, which include “technical” aspects at a technology offering centre, for example: connections to networks such as the Internet and computers, “economic” aspects such as the costs of using ICT at the e-community forums or TSCs, and “social” aspects such as cultural, educational or literacy, and social barriers limiting the use of ICT.

In this study some elements of the “ICT Access Rainbow” are evident in data gathered and and presented in the Data Analysis section.
The next section briefly describes some aspects of ICT centre development and operation which have, in the past few years, contributed to success and failure of ICT4D projects. This description could shed some light later on in the article as to factors which have contributed to the success of the Dwesa Siyakhula Living Lab (SLL) and Cofimvaba Thusong Service Centre (TSC) and the failure of the Cradock Chris Hani District Digital Hub.

**Factors That Have Contributed to the Failure of ICT4D Projects**

The telecommunications infrastructure of sub-Saharan Africa is very underdeveloped, despite the fact that the South African telecommunications infrastructure was (in the early 2000s) more advanced than that of the other neighbouring countries in the region (Goldstuck, 2013). The World Economic Forum Global Information and Communication Report (2012) stated that the sub-Saharan African region still has the least developed ICT infrastructure in the world, and also has a severe lack of ICT skills. South Africa is located within the sub-Saharan region. Furthermore, international and national data made available during the past few years indicate that access to and use of ICT infrastructure and services is not universal in South Africa (Lesame, 2009; Chisango, 2013). It is imperative therefore that this situation of declining ICT service deployment be reversed by establishing more ICT centres moving into the future.

**Poor or Absence of a Telecommunications Infrastructure**

African countries have a less developed ICT infrastructure when compared to countries in other regions (Pitt & Levine, 2003). Recent African ICT statistics (2012-2013) indicate that African countries, such as Nigeria, Mauritius, and Tunisia are advancing faster than South Africa (Goldstuck, 2012; Lesame, 2013a). Some structural challenges which have contributed to slow or in some countries retarded ICT facilities growth in some African countries, include the following, according to Mbatha and Lesame (in Lesame, Mbatha, & Sindane, 2012):

- Historical structural imbalances and inequalities caused by colonialism, capitalism and related economic conditions that impoverished Africa and its people;
- Low ICT penetration in Africa, which include the following:
  - Lack of investment in the ICT infrastructure;
  - Investment inefficiencies in the sector;
  - Inadequate private sector involvement in advancing ICT deployment initiatives;
  - Foreign exchange scarcity;
  - Poor management incentives in the ICT market; and
  - Insufficient ICT regional development.

The limited telecommunications network infrastructure and level of Internet literacy and accessibility affect the use of such technology and leads to inadequate information sources (Musiyandaka, Ranga, & Kiwa, 2013). Community service centres are widely regarded as a key measure of offering a wide range of services needed by the communities to the communities, and empowering to bring about their own development (Conradie, Morris, & Jacobs, 2003). The national recognition that ICT centres contribute towards community development has pushed African countries like South Africa to accelerate the development of such centres with the hope that social ills such as high illiteracy levels and lack of access to developmental information will be reduced.
The three ICT centres researched in this study were developed towards contributing in one or another to community development.

**Absence of a Well-Integrated or Unclear Government ICT Policy**

In the last decade South Africa has failed to develop a well-integrated ICT policy which promotes the development and use of advanced technology such as broadband. Former Communications Minister, Dina Pule (2012a; 2012b), stated that the government remains committed to delivering “100 per cent broadband penetration by 2020 and delivering a million jobs by 2020”. Similar promises of ICT infrastructure delivery by government have been made in the past by other ministers, but most of these promises have not been fulfilled and the country’s ICT services remain underdeveloped and consequently Minister Pule was fired in 2013 by President Jacob Zuma for, among other reasons, poor delivery of ICT services, nepotism and corruption (City Press, 2013; HumanIPO, 2013). Critical ICT industry analysts, such as Muller (2012), believe that what is needed to deliver ICT infrastructure and services in South Africa is “less talk and trips by government officials and more action”. Current Communications Minister Yunus Carrim published a new Broadband Policy in November 2013, which is aimed at providing wider access to ICT services and broadband Internet (Mungadze, 2013). The sooner the stipulations of the Broadband Policy are implemented in reality will access to and use of ICT services improve in South Africa. This ICT infrastructure improvement could contribute towards different levels of community development. Additionally, the International Telecommunication Union (ITU, 2011) regards the mobile revolution – including the emerging mobile-broadband Internet – as a key enabler to achieve internationally agreed development. In 2013, more than 94 per cent of South African households have access to mobile phones (e-Skills Institute Newsletter 2013, Edition 21). The challenge is to apply and use these mobile phones to advance educational initiatives and create jobs.

**Lack of Social Capital to Use ICT or Lack of Interest in Using ICT**

In order for individuals to use technology, they should be positively inclined to using technology. Individuals who do not like technology because of various personal and cultural preferences often do not use technology and are also technophobic towards technological use. This technophobia is also referred to as “retrogressive behaviour” in technological language (Howard, 2008, in Musiyandaka et al., 2013), which means behaviour that displays ignorance towards ICT and lack of interest in learning about ICT. Van Dijk (2008) refers to this kind of barrier to ICT use as lack of motivational access, which could be a result of variables such as people having no time for or liking of computers, lack of ICT skills, rejection of the medium (Internet and computer games), lack of money and no need or significant usage opportunities. Additionally, Ngcobo and Herselman (2006) mention illiteracy and cultural beliefs (for example, fear of computers) as some aspects of “retrogressive behaviour”) which inhibit some persons from using computers. Chisango (2013) alludes to lack of ICT knowledge and knowledge of one language (Xhosa, in the case of Chris Hani municipality in the Eastern Cape Province, where Chisango conducted research) is also a barrier to Internet use as users prefer to use their own language, Xhosa, instead of English which most people in that rural area cannot speak or write.

It is crucial therefore, that local people should be educated towards a positive inclination about computers and this is an area where we as researchers should play a significant role, by teaching those who are fearful of computers about how the computers can help to improve their education and consequently their lives. Local ICT users should also be encouraged to learn the English language which is dominant on the Internet while they can also promote the use of their own languages online.
Irrelevance of Technology to Local Problems

Technology can fail to develop some communities because the introduced technology was not aimed at assisting local people towards solving their specific socio-economic challenges. This lack of relevance of technology to solving local problems has resulted in some community members not using ICT as they did not see its relevance to improving their lives. Musiyandaka, Ranga, and Kiwa (2013) term this barrier to ICT use “design-reality gaps”, which indicates a situation in which ICT4D projects were developed in community without the necessary awareness of the socio-cultural context of local people, lack of motivation and lack of understanding of the role of ICT in solving urgent local community challenges, a shortcoming which often results in the failure of an ICT project in its initial or pilot stages or could lead to a project to be unsustainable in the long run especially if community members fail to adopt the project and use it as their own. It is therefore critical for ICT developers to communicate better with members of each community to assess what the community development needs are, so that each ICT projects is developed towards trying to assist a community towards addressing the identified social challenges. This also improves the chances of community members using the ICT centre, marketing it to more community members and consequently owning it.

Lack of Dedication by ICT Centre Operators to the ICT Project and Community Development

Communication to members of a community about how an ICT centre should be operated is one of the important factors which determine the success of these centres, as already stated earlier on in this article, as per collaborative model to ICT project development (Ishmael, 2013). It is critical, therefore, that individuals who are able to include other community members in the running of ICT projects be appointed to operate such centres, not individuals who have no interest in selling the idea to other community members and including the latter in the running of a centre. One proponent of the collaborative model to community ICT centre development, Conradie (1998) states that community ICT centres require “local pioneer scouts” to run such centres, and that these development leaders should be trained in financial control and human resources management, if the centre are to succeed. Furthermore, the developmental and entrepreneurial activities at rural telecentres tend to operate according to the principles of Integrated Regional Development (IRD). This approach involves an investment in developing the knowledge, skills and entrepreneurial abilities of the local population, and requires considerable predevelopment activity (Conradie, 1998). There should be more cooperation and communication between members of the community and ICT centre managers as well as funders. In the ICT centre that has failed in its quest to develop the Cradock community, as far as this study found out – as explained in the results section – it is evident that the ICT centre manager failed to implement the collaborative or stakeholder approach to ICT centre development towards community development, hence the non-operational status of the Chris Hani District Digital Hub. Stakeholders should also highlight the value of community education.

The next section looks at ICT success factors which those who operate ICT centres should take cognisance of and apply when developing and running these centres.

Factors That Have Contributed to the Success of ICT Centres

Research in South Africa and other African countries have indicated that the following factors are some of the socio-economic conditions that contribute to successful development and running of technology centres for ICT skills training and education.
Increased Role of Public-Private Partnerships in e-Centres, Education and Business Development

Public-private-partnerships (PPPs) in establishing and operating ICT centres in rural and urban areas, have led to successful running of such centres and also e-skilling of citizens (Marshall & Taylor, 2005; Hamid, 2010). A public-private partnership (PPP) is “a cooperative venture between the public and private sectors, built on the expertise of each partner, that best meets clearly defined public needs through the appropriate allocation of resources, risks and rewards” (The Canadian Council for Public-Private Partnerships, 2008). In Australia, LaRocque and Latham (2003) define PPPs, at one extreme, as partnerships between public sector investors and businesses for the purpose of designing, planning, financing, constructing, or operating infrastructure projects that would normally be provided through traditional procurement mechanisms by the state. On the other extreme, they describe PPPs as any private and public cooperation or collaboration that aims to achieve a common goal, no matter whether the partnership is formal or informal. These developed countries’ definitions of PPPs are slightly different in purpose from the South African definition and interpretation of this concept, which attempts to consider community needs and deficiencies, such as introducing an element of empowering the disempowered who did not necessarily fund the establishment of that ICT project but benefit from its inception and operation. The South African definition states that a PPP is a joint public and private sector development funding project “which is part and parcel of an empowerment programme with emphasis on community driven development” (Motshekga, 1999). These partnerships have been implemented in South Africa not only in the ICT sector but also in education, health and other sectors to serve public interests or meet public service obligations. According to the ITU InfoDev (2008) governments in both developed and developing countries are turning to the private sector for the delivery of infrastructure services because of the following reasons:

(a) Recognition that the private sector organizations have superior management skills, understand the market and marketing forces, are motivated and financially efficient, even though they are driven by financial profit and may have a limited tolerance for risk in challenging situations; and that

(b) Government has a mission and responsibility to meet social and developmental needs and service objectives which are in the public interest; it has financial resources it can invest in to secure skills and government direction or vision and financial reasons.

The private sector, after shifting fortunes in development theory and practice over the years, is widely recognized as the key to economic growth (Garforth, Phillips & Bhatia-Panthaki, 2007). There is a growing trend, internationally, to pursue and implement PPPs as ICT and telecommunications services delivery tools and the success of the PPPs in achieving development goals has yet to be assessed by future research in many developing countries. The growth in private sector participation has been a catalyst for the expansion of PPPs in the education sector, hence the explanation of this growing ICT-funding imperative and trend in this section in an elaborate manner.

Due and critical consideration of PPPs is also necessarily provided, in this section, because there is a paradigm shift in international communication and telecommunications sectors towards PPP-ICT project funding, a shift from previously either government-only or solely private sector funded. Fife, Hosman and Pereira (2008) attest that this shift towards PPP-ICT funding is globally viewed as a more effective way to manage development assistance than previous means and that although PPPs have been around for over a hundred years in the United States of America (US), growth in their use began in the 1980s and has continued in part because this kind of collaboration is thought to allow a more effective way to manage risk, garner capital for large scale efforts, and to deliver services in a cost-effective manner”. What is clear thus far, and visibly observed by
ICT researchers globally, is that there is a growing trend also in developing countries, of ICT private firms, such as Microsoft and Cisco pursuing ICT funding of development projects in developing countries. The World Bank also advocated the implementation of ICT PPP projects for the advancement of development initiatives (World Bank, 2006).

South Africa has adopted the ICT PPP trend, the purpose of which is to empower citizenry and develop ICT capacity at individual, group (in ICT4D centres such as the ones reported on in this article) and institutional, including schools, universities, post offices and libraries levels. The imperative to develop strong PPPs in the delivery of South African education is the result of the need to address educational challenges such as ICT skills shortages to ensure that the government’s broader economic and social objectives are met. Private companies have advanced ICT skills, which government departments may not have and the private sector has taken it upon them to assist government in ICT skills development, e.g. Cisco and SAP (a technology development company). While PPPs are the key to education service delivery, what must be reconciled is the interest of government on the one hand to ensure service delivery at a low cost, with that of the private sector aimed at maximizing returns on investment (Lesame, 2009). The long term benefits of PPPs are that as a result of private sector participation in them, government can redirect extra resources to other priorities such as poverty alleviation, housing shortages and health challenges.

Langa, Conradie and Roberts (2006), concede that the South African government and private-sector bodies have responded to South Africa’s digital disparities by launching a range of policies and programmatic interventions. These have mostly been attempts to increase access to digital ICTs in rural areas, including the provision of email or Internet access to schools and installation of infrastructure at centres that serve previously disadvantaged communities. Furthermore, ICT access provision projects established at universities, including Walter Sisulu University in Umtata (Eastern Cape Province). No one entity has the resources to fully address the imbalance of access to skills development for the underprivileged majority (Hamid, 2010). Some of the multi-stakeholders engaged in the new e-skills training initiative include universities, government Ministries of Higher Education and Training and Communications, civil society, and business and global development partners (e-Skills Institute, 2012). Universities participating in the ICT training programs in South Africa’s nine provinces include the Durban University of Technology, the University of Pretoria, Walter Sisulu University, Vaal University of Technology, University of Limpopo, and the University of the Western Cape. Civil society organizations involved in the project include the South African Local Government Association, which represents local municipalities and ICT training requirements thereof; the telecentre organization, an institution representing the e-skill training needs of communities and telecentres located in such communities; and the International Computer Driving License (ICDL), an organization specializing in teaching computer and online courses for different occupations. Global developmental partners engaged in the projects include the United Nations Development Programme (UNDP), and the governments of Kenya and Rwanda. Business partners include the South African telecommunications incumbent, Telkom, private company, Cisco, which add both financial and human resources as well as advanced ICT expertise.

Organisational Information Sharing About Community Development Issues and Challenges

Another factor which is closely related to the formation of collaborative PPPs towards community development is the sharing of development and community information by the parties planning to introduce technology in rural areas. This is true especially for government agencies in South Africa such as the Universal Service and Access Agency of South Africa (USAASA), an organization that was legislated to establish community-based ICT centres since 1996, when the Telecommunications Act No. 103 was enacted and mandated this agency to establish ICT4D centres.
This agency, USAASA, has gathered much information about telecom access deficiencies in South Africa such that it can share this wealth of information with other organizations which have interest in assisting government in the delivery of ICT facilities and services. Communities interested in developing ICT centres in their areas should also be willing to share their development challenges to organizations that are interested in assisting these communities towards rolling out ICT4D centres and related educational facilities in these centres.

**Progressive and Inclusive ICT Policy towards Creating an Information Society Critical and Necessary**

Technology changes rapidly. This necessitates that governments also catch up by developing ICT policy in line with advancing technology. The South Africa has failed to develop effective ICT policy, as stated in Section 3 of this article and this lack of ICT policy development for over a decade (between 2003 and 2013) has contributed to the slow growth of the national communications sector. Until the huge national urban-rural digital divide is reduced or eliminated, South Africa is not a real information society at this stage (Lesame, 2013a). The different economic, political, and social revolutions that have transformed South Africa into an industrial society have not changed the country into a fully-fledged information society. Neither is South Africa producing abundant information. A clear ICT policy is therefore required to ensure smooth transition from an industrial to an ICT-using and information producing society. The government also has national responsibility of running educational campaigns which should be geared towards educating those South Africans still unaware of what ICT is, as well those who show no interest in ICT usage as a results of ignorance and other factors, about what is it that ICT can do towards the improvement of those who use it.

The research methodology employed to gather and analyse data is described in the next section.

**Research Methodology**

Due to the diverse and enormous nature of urban, semi-urban and rural areas of South Africa, the study only targeted selected centres located at four rather than all nine provinces. The four provinces are KwaZulu-Natal (KZN), Gauteng, Western Cape and the Eastern Cape. These provinces were selected mainly because of their imbalances in terms of ICT development, with Gauteng and the Western Cape provinces being highly urban and having an advanced ICT infrastructure and ICT training programs; while the Eastern Cape and KZN have large rural areas and experience high levels of the digital divide with ICT infrastructure in these two provinces not as advanced as in Gauteng and the Western Cape provinces. Most advanced ICT services are found in the Western Cape and Gauteng Provinces while the Eastern Cape and KZN mostly have rural areas and poor ICT infrastructure. The provinces are depicted in Figure 3.
Furthermore, in the four sampled provinces, three or four centres were conveniently selected by virtue of these centres being either urban or rural and also portrayed online as being operational. Choosing rural and urban centres would allow the researchers to make informed comparisons about e-skills taught at urban and rural areas due to the vast differences in ICT infrastructure and general community conditions including work opportunities offered by a centre to the members of the local communities. This article, however, reports on information gathered from the Eastern Cape Province and information collected from the other provinces will be reported in other articles, since the length of an article would be too extensive if all the congregated information is compressed into a single publication.

**Research Design and Participants**

To determine what ICT is used by the persons using the sampled ICT centres and for what purposes the users employ ICTs to, triangulation was selected and employed to conduct this study, combining personal interviews (a qualitative research method), and a semiotic analysis of selected online videos on the centres. Mouton and Marais (1988) define triangulation as the “use of multiple methods of data collection to increase the reliability of observations”. The personal interviews were selected because the researchers intended to have an in-depth understanding of what the users do at the centres, where the centres are located and what the geographical and social conditions of the villages and towns where the centres are located and also converse widely with the users about how the centres have improved education and lives of local people. Personal interviews were employed because they allow penetration into subtle social and personal meaning of the e-skill teachers and learners. In this research, the interviews were also employed to ask those e-skilling and e-skilled about the role of ICTs in e-literacy training at the centres. Personal interviews were also employed to ask respondents (and school children at Dwesa village) questions about what they learn at the ICT centres and how their use of the centres had changed their lives. Semiotic analysis was employed because, after conducting some field research (personal interviews) at the centres, the researchers experienced information gaps and felt a need to conduct more research on the activities happening at the centres and also on the role of the centres on community development online, especially concerning issues that the respondents present at the centre could not explain in detail, for example, a description of all the technology used at the Dwesa centre and its uses – the teachers the researchers spoke to could not fully explain what the technologies were but knew that the technology enabled them to access the Internet and communicate with people and organizations located in other parts of South Africa.

Online video analysis, which is part of audio-visual qualitative research, and according to Kellehear (1993), has many traditions within it, including narrative theory, reader-oriented criticism, genre study, ideological analysis, as well as psychological and feminist criticism. Most of these traditions begin with a semiotic approach which focuses on analyzing images, graphics, language, voice, music and sound effects in online videos. This analysis was carried out in this study for the main purpose of determining the role of the centres on improving users’ lives from the user’s perspective. A combination of research methods also seemed desirable and useful for the main purpose of ensuring the validity and reliability of the results. The main reason for using triangulation is to gain more information from the respondents to answer the research question/s in a satisfactory manner and also to increase the reliability of the research results.

The questions asked in the interviews were arranged in an interview guide. The interviews were carried out during the course of 2013. The participants for the study included both centre managers (school teachers in Dwesa village, ICT trainers, ICT trainers and other stakeholders; n = 16), and school children (n = 26). Three personnel were spoken to at the Cradock ICT centre and no students; three women centre managers were interviewed at Cofimvaba ICT centre and two pu-
pils; from the Dwesa data were collected from 24 pupils and 10 teachers, ICT trainers and providers as other related stakeholders. Total population, n = 42 (Eastern Cape only).

**Research Funding**

To carry out the study, the researchers were granted research funding by the University of South Africa Management Committee (MANCOM), through the School of Humanities and the Research Office of the University of South Africa, the Women-in-Research Program (Bopape 2012). The researchers travelled to the centres by air from Pretoria, Gauteng Province (where the researchers live and work) to East London in the Eastern Cape Province. From the city of East London the researchers travelled by car to reach the Dwesa village and the small towns of Cofimvaba and Cradock where the ICT centres are located.

**Sampling Techniques and Data Capturing**

Consequent to selecting the urban, semi-urban and rural areas, further sampling of the centres was undertaken by using purposive sampling. A list of available and working e-centres was sought and emailed to the researchers by a staff members employed by the government agency responsible for deploying telecentres in communities, which is known as the Universal Service and Access Agency of South Africa (Mahlangu, 2013). This list, however, consisted of a few telecentres. This necessitated that more centres be identified in order to gather more data to achieve the aims of the study. Sampling of the centres was done objectivity, by applying the non-probability sampling technique of purposive sampling, where the researchers purposively selected centres that were presented to them by the USAASA staff members responsible for e-centre development. However, some centres on the USAASA (Mahlangu, 2013) email list were not operating, so the researchers access the Internet in search of operating centres from the Government Communication and Information Service (GCIS) Web page (2013). It is on this Web site that the Cofimvaba and the Cradock centres were purposefully selected.

Multi-stage sampling is used as a general sampling technique for the research because it is necessary to choose a few samples at different levels of the research process, i.e. provinces; urban, semi-urban and rural areas; townships and villages; e-skills trainers and trainees, all had to be sampled in order to conduct the applied research scientifically to ensure objectivity and reliability of results. Data were captured and recorded through the use of media, an iPads and a digital camera, as well as note-taking on writing pads. Media such as the iPad and digital cameras are in their very nature objective tools of collecting data as they capture interviews and qualitative data such as digital pictures immediately during the interview time. They also capture dates and times of interviews so the information they capture is accurate and reliable.

**Data Analysis Procedures**

Data analyses were categorized into themes, as these themes and key ideas became apparent in respondent answers. Thematic analysis is therefore that qualitative data analysis method employed while a table is also used to report some respondent answers. To execute qualitative semiotic analysis of the data (and also interview responses), the following procedures (Kerlinger, 1986) were also executed:

(a) *Available material were assembled and put together and themes identified;*
(b) *Oppositional elements in the data were identified (for example, village and town e-centres and so on);*
(c) *The different accounts or answers of respondents are reported in a table, especially those that were memorable.* To execute this procedure, the researchers reported responded stories and accounts, and captured some respondents on video and pictures.
(d) *Critically apply the theoretical traditions* used as the basis of this study to interpret and reflect on the data, while being sensitive to and cognisant of socio-economic conditions the centres are located under having observed the locations and geographical condition during the site visits.

### Data Analysis: Findings and Discussion

The individuals interviewed at the Dwesa and Cofimvaba ICT centres had positive comments about how the centres have improved their education, computer skills, business and related knowledge. In contrast, individuals spoken to at the Cradock ICT centre stated that the centre was “not operating” and had no impact on their lives since its establishment. The centre had been closed for a few years and computers at a laboratory could be seen through a window full of dust. The interviewees in the latter centre were indifferent about the current centre collapsed status and stated that its opening and function depended on the centre manager, who, on the contrary, was not communicating with community members on how to re-open and operate the “digital hub”. One of the micro-managers working at the centre at the time of the research visit provided the researchers with a mobile phone number of the centre managers. The researchers phoned the managers who stated that he was attending another meeting and would call the researchers at a later stage, which did not happen. Follow-up calls made by the researchers to the same mobile phone number could not reach the manager.

Most of the gathered data were qualitative in nature as respondents spoke from the mind about their personal experiences at the centres. Information about the centres is reported next.

#### Dwesa Village ICT Centre

Dwesa village is a rural area in the former Transkei region of the Eastern Cape Province, which is located about 400 kilometres from the city of East London on the Wild Coast in a fishing community. The technology centre was opened in 2005 and is located at Mpume Secondary School in the Mbhashe municipality next to the Dwesa-Cwebe Nature Reserve. Although Dwesa is situated in a beautiful country side, the gravel winding roads through which one travels to get the ICT centre are in a very bad condition. Multi-dimensional development is missing in this area and region, but it is necessary that government develop this area and start by developing the road infrastructure to ensure that travelers are able to reach Dwesa safely in the first place. There are also not many employment opportunities in this area and multi-dimensional development projects could bring much-needed jobs to alleviate poverty and destitution. Poverty and destitution can be seen as one drives through the many villages, even though some residents seem to be managing, judging by the few modern and electrified homes one sees along this route. It is also not practical, on the part of the Siyakhula Living Lab (SLL), to expect residents of so many villages to make use of one ICT centre as there are many people dwelling in the many villages one travels through to reach the Dwesa SLL. A personal interview with a female teacher at the centre revealed that the ICT training centre is a PPP with partners including telecoms operator Telkom’s Centre of Excellence, Dwesa SLL (local people), Rhodes University, University of Fort Hare, Cisco, Dwesa community and the local municipality, Reed House System (a software development company), SAP, Nokia, Microsoft, and some NGOs. According to the teachers, at least 17 local schools – teachers and school children - make use of this centre for ICT services. School children interviewed mostly cited using the Internet for research purposes to complete school projects and also using computers to access information and use social media. The centre users come from many villages including Nqabara, Mpume, Mthokwane, Nondobo and others. The total population residing in all the villages in the area is estimated at 25,000.

Some school children that these researchers interviewed for this study are in Figure 4.
Residents of Dwesa village adopted ICT to promote development in the area, fostering ICT awareness and a sense of ownership by the community which are further viewed as crucial factors in community development and computer literacy education in the region (Mapi, Dalvit, and Terzoli, 2006). That study by Mapi, Dalvit and Terzoli (2006) highlighted a difference between elderly people owning small businesses, who were the most interested in the possibility of integrating ICT into their activities, and young people, who were skeptical about the benefits of ICT; and that in general, females seemed to be particularly more enthusiastic about ICT, possibly seeing it as a way to gain status in a particular society. This research, however, revealed that all the Dwesa ICT centres users were positive and optimistic about the benefits they had derived from using the centre, especially improved education and ICT usage skills. Most elders using the centre were females but school children were equally mixed in gender; there were as many girls as there were boys, although the boys were mostly older (teenagers) and the girls younger than 10 years old. Technologies used for ICT services at this centre include WiMAX, Wifi and Very Aperture Satellite Terminals (VSATs) (Dalvit, Siebörger & Thinyane, 2012). Some responses from users of this centre are included in Table 1 below.

**Cofimvaba Thusong Service Centre**

Cofimvaba is a small town located in the Chris Hani District Municipality in the Eastern Cape Province. The town is situated about 200 kilometres from the bigger and more affluent Queenstown, where the researchers resided during the period of their visit. Queenstown is located further 200 kilometres from East London. The population of Cofimvaba is estimated at 8,793 people (“Cofimvaba”, n.d.). Interviews with the three female managers of the centre revealed that government departments established the ICT centre, for example, the GCIS <http://www.thusong.gov.za/provincial_maps/ecapecofimvaba.htm>, Department of Home Affairs and also other departments which offer members of public services at the centre. ICT centres established by the GCIS are called Thusong (meaning Help in South African Sotho language) Service Centres (TSCs). Information services offered by the centre include the Internet, e-
government (applications for birth and death certificates, identity cards, passports and so on), health information, employment opportunities, access to information about universities (for example, the University of South Africa), computer, photocopying, facsimile and printing services. Other services offered by this centre are depicted in Figure 5. There is no doubt that most local people make use of this centre to access different technological and information services.

**Figure 5: Information services offered by the Cofimvaba TSC**

Source: Lesame (2013b)

**Cradock**

Cradock is a small town located about 292 kilometres from Port Elizabeth and about 200 kilometres from Queenstown. The town is an administrative hub of the Inxuba Yethemba (Place of Hope) Municipality. The estimated population of Cradock is 28,689 (“Cradock,” n.d.). Cradock’s economy is supported by agriculture and farming and involves the production of wool, beef, dairy, fruit, lucerne and mohair. There are also game farms surrounding the town which promote tourism. However, observation and analysis of the town revealed that the town has a few historical buildings and businesses that employ some citizens but there are also many unemployed citizens that can be observed idling in the town. The ICT centre is situated in the residential area just outside the town centre. The centre is called Chris Hani District Digital Hub – in Figure 6.

The researchers were relieved to see the ICT centre building upon arrival at the site. However, this relief was short-lived once it became clear that the centre is closed and no ICT training is offered at the centre. The two officials (male and female) working in the office busy themselves with administrative tasks such as typing, printing and managing the office. The male respondent stated that the centre had been closed for a while but the manager of the centre, who also owned the building, was the only person who could explain why the centre was closed. The office was used to assist local persons to start small and medium-sized enterprises, working with the local municipality and government departments. No technology is used for ICT skills capacity building and the computer laboratory is locked and deserted. The ICT centre has totally failed and it is apparent that the community and community organizations are not involved in activities of the “centre”. Reasons for the failure of this imaginary “digital hub” (Figure 4) could not be established as the owner failed to contact the researchers as he had alluded to telephonically, nor were the researchers able to contact him as his phone was no longer accessible. This centre is also called the “Institute of Science and Technology”. The “hub” or “institute” could be revived if the “owner” could form links with community organizations, government departments, business and other partners to ensure that the “digital hub” works and assists community members with ICT services. In their analysis of the effectiveness and sustainability of ICT projects in Asia, Songan, Harris, Bala and Khoo (2000) conclude that a prerequisite for success of ICT centres is a collaborative approach (Ishmael, 2013), in which the community participates fully in all the stages of the
project. In South Africa this approach is known as a multi-stakeholder or collaborative approach to ICT development.

Figure 6: The Chris Hani District Digital Hub in Cradock, Eastern Cape Province
Source: Lesame (2013c)

Table 1 provides some questions asked to the respondents and some answers from a few respondents.

Table 1: Selected respondent answers

<table>
<thead>
<tr>
<th>ICT Centre</th>
<th>Research participant response</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dwesa SLL</td>
<td>“After finishing matric I did not get a job and went to work as a domestic worker in East London. My future was not clear. Then this centre opened and I came back to study computers and the Internet at this centre. Now I teach other people computer skills and study with Rhodes University”.</td>
</tr>
<tr>
<td>Chris Hani District Digital Hub, Cradock</td>
<td>“Nothing is happening here. This place closed a long time ago”.</td>
</tr>
<tr>
<td>Cofimvaba TSC</td>
<td>“Most of the services we offer are government related services. People apply for IDs (identity documents) here and get birth certificates at this TSC. School children type their school work here. Sometimes we use the Internet when it is working. We get Internet connection from USAASA but today it is not working. We also students who study at Unisa and send their assignment online here when the Internet is working”.</td>
</tr>
<tr>
<td>Dwesa SLL</td>
<td>Most people in Dwesa are not educated, so we are working with Rhodes University, the University of Fort Hare Hare and this company called Reed House Systems to make Xhosa software so that people at the centre can write documents in Xhosa because they do not know English”.</td>
</tr>
<tr>
<td>Dwesa SLL</td>
<td>“We learn about computers and find information about school projects”. “The town is far so people get information here”.”</td>
</tr>
</tbody>
</table>

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We work with government departments like Home Affairs and Social Development. Home Affairs delivers IDs, birth and death certificates to people here. Social Development offers advice and information on HIV/AIDS and counseling, empowers victims of domestic violence and abuse; they also help with social and disability grants (together with SASA or the South African Social Security Agency) and help with advice on substance abuse and other challenges that we ask them to help us with”.

“We also give people government newsletters and pamphlets with information about jobs and other projects. One of the newsletters they get is Vuk’ uzenzele which one can also get from the Internet”.

“I am happy when I use the computer because they show us many things and we can come here in the afternoon when the centre is open. I have learnt many things here, I even learnt about Web art”.

“The Internet is changing our lives” I registered my catering service company for the schools online form from the Ministry of Finance at this centre. My business is growing slowly but surely. Thanks to the people who brought this centre here, our lives have changed for the better” (woman in her fifties).

Ethical Considerations

The researchers are aware that ethical considerations have to be seriously considered throughout the study. As a matter of principle, the researchers respected the right to privacy and anonymity of the respondents as well as confidentiality of respondent information. Respondents were informed that data gathered from them would be used for academic and teaching purposes, and that the results would be published in academic journals.

Conclusions

Detailed analysis and experience around the world reveals ample evidence that, used in the right way and for the right purposes, ICT can have a dramatic impact on achieving specific social and economic development goals as well as assist in pursuing broader national development interests. The real benefits lie not in the provision of technology per se (as in the failed Cradock ICT centre), but rather in how technology is applied to create powerful social and economic networks by dramatically improving human communication and exchange of information – as experienced by the individuals and groups using the Dwesa village and Cofimvaba town technology centres. This research found that the Cradock ICT centre is dysfunctional and has no development impact on its immediate community while the Dwesa village and Cofimvaba ICT centres play very significant and positive role in the improvement of the lives of people who use these centres for the different purposes stated in this article. ICT, therefore, in these two communities plays a significant contribution to personal and community development, and in some instances is contributing to educational improvement and economic growth. The challenge on the Cradock residents and community organizations is to follow the successful approach to ICT4D, and thus adopt a multi-stakeholder approach to development rather than expecting a one-man show to run a technology centre that is supposed to develop a community. Proper adoption and use of ICT is important and remains a critical challenge. Properly diffused and used, telecom technology has the potential to improve user education and promote community development, as well as facilitate e-government and distance education (or e-education) which are prime South African development goals.
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References


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