

# 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).

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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-

ferent 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 (MobiLearn) 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.

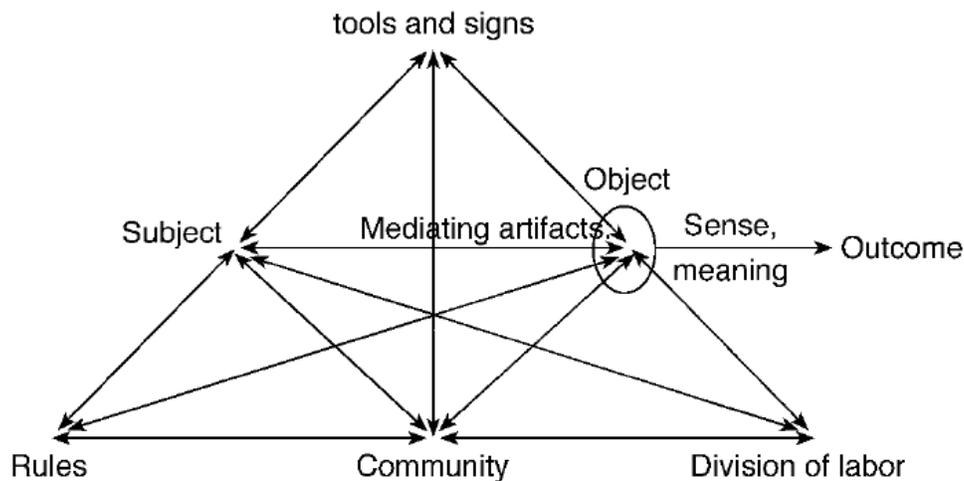
## Activity Theory

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 American 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”.

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. Rule 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, 200, 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.

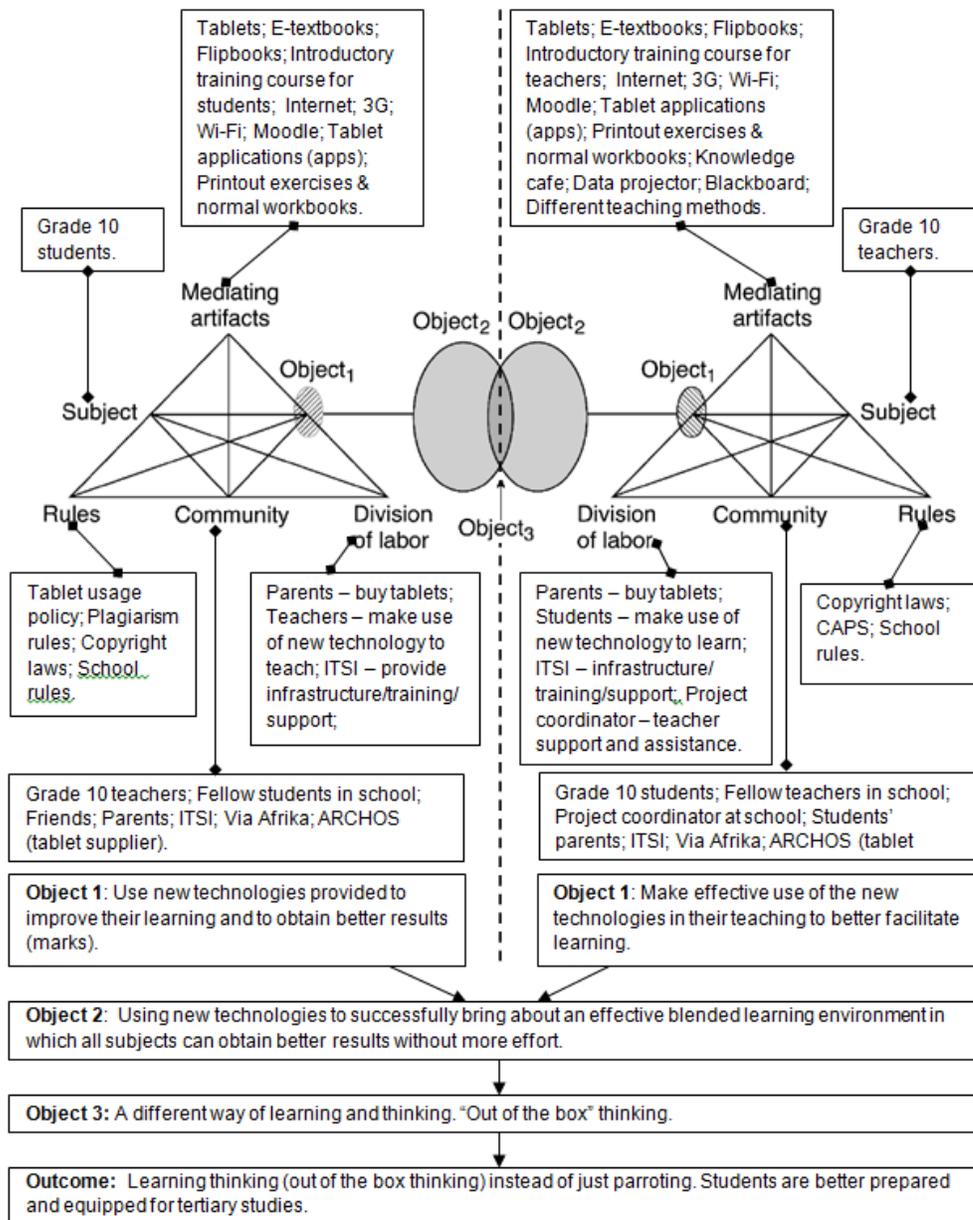
Some of the teachers involved in the project did have prior experience with tablets. The younger teachers seemed a lot more comfortable with the use of tablets and e-textbooks than the older teachers were.

### **Object**

For students the object of the activity ( $Object_1$ ) 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 ( $Object_1$ ) of two interdependent activity systems are reconstructed by the activity system to become collectively meaningful objects ( $Object_2$ ). In such a connection of activity systems the objects can also evolve to become a “shared or jointly constructed object” ( $Object_3$ ) (Engeström, 2001, p. 136).

For the teachers, the object of the activity ( $Object_1$ ) 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 ( $Object_2$ ) 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.



**Figure 2: Interplaying Activity Systems of Students and Teachers**

A third object (Object<sub>3</sub>) 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-

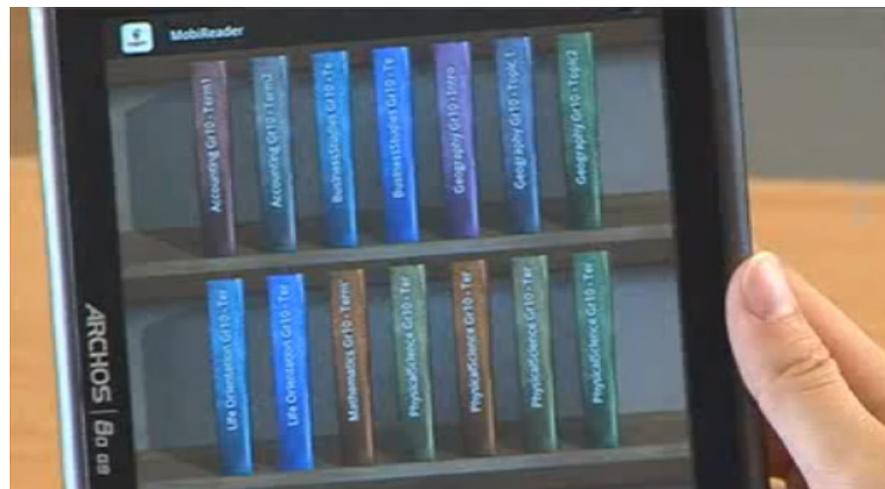
sulted in the shaping of internal activities – one of the basic principles of Activity Theory (Engeström, 2001).

## 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)



**Figure 3: A Library of Textbooks on One Tablet** (ViaAfrikaFuture, 2012)

- 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

## Adoption of e-Textbooks

visual aids (like videos) that would not have been available to him in a traditional textbook. Another student explained that for auditive 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 sessions, 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

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 Cafe), 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

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/flipping 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 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.

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.

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