# 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

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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



Figure 1: Areas of Research Interest

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-
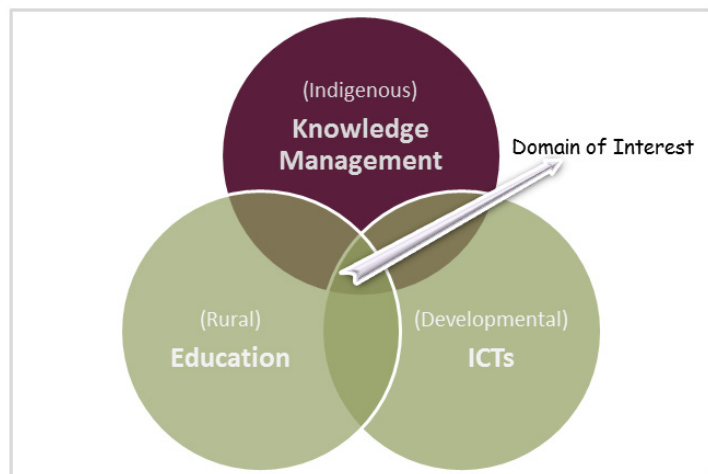
ogy [built] on Shulman's formulation of 'pedagogical content knowledge' and extend[ed] to the phenomenon of teachers integrating technology into their pedagogy" (p. 1017).

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:



Figure 2: TPACK Framework

> 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)
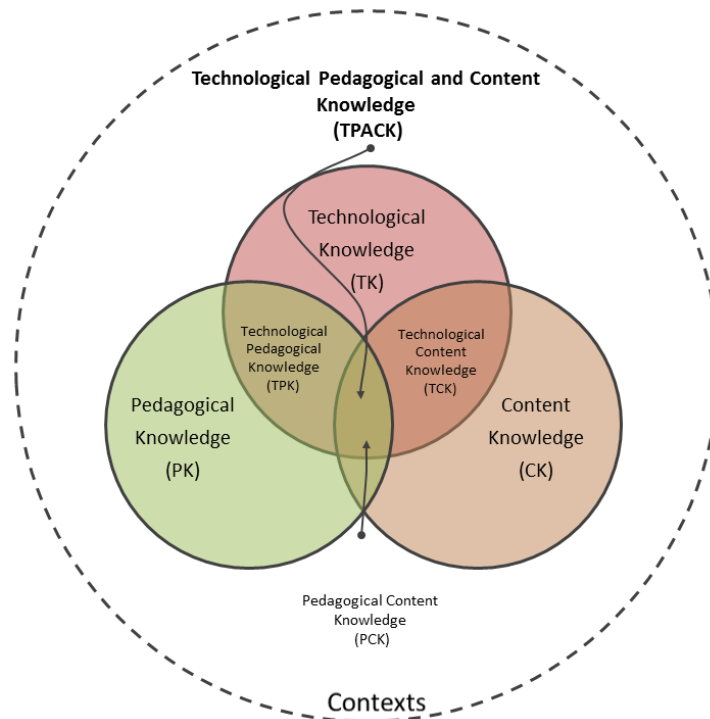
From the above description, there is a danger of interpreting the term 'technology' as a synonym for ICT. Angeli and Valanides (2009) argue, for example, that this reflects a lack of theoretical clarity, which is essential for using the TPACK framework effectively. They provide this clarity and in so 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.



Figure 3: High-level Snapshot of the Education Landscape

## *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)
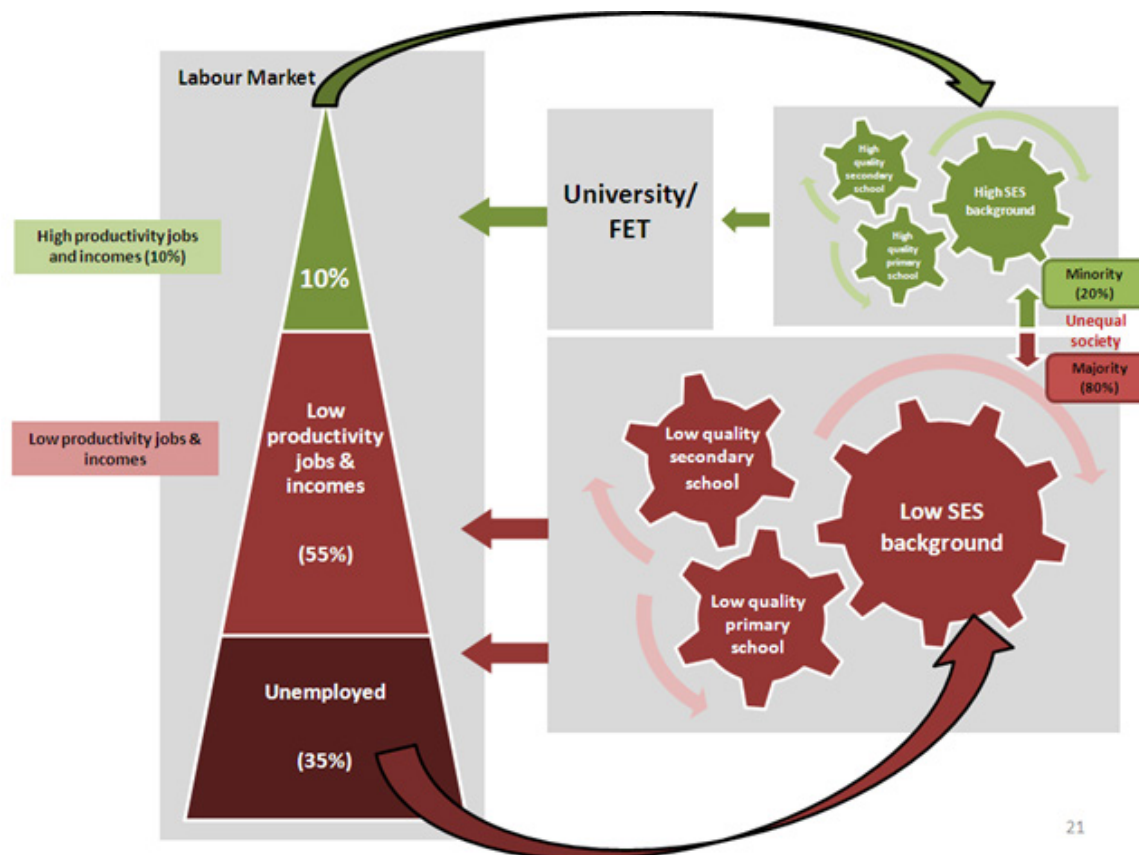


Figure 4: Spaull's Framework for Understanding South African Education System

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 over-stretching 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.
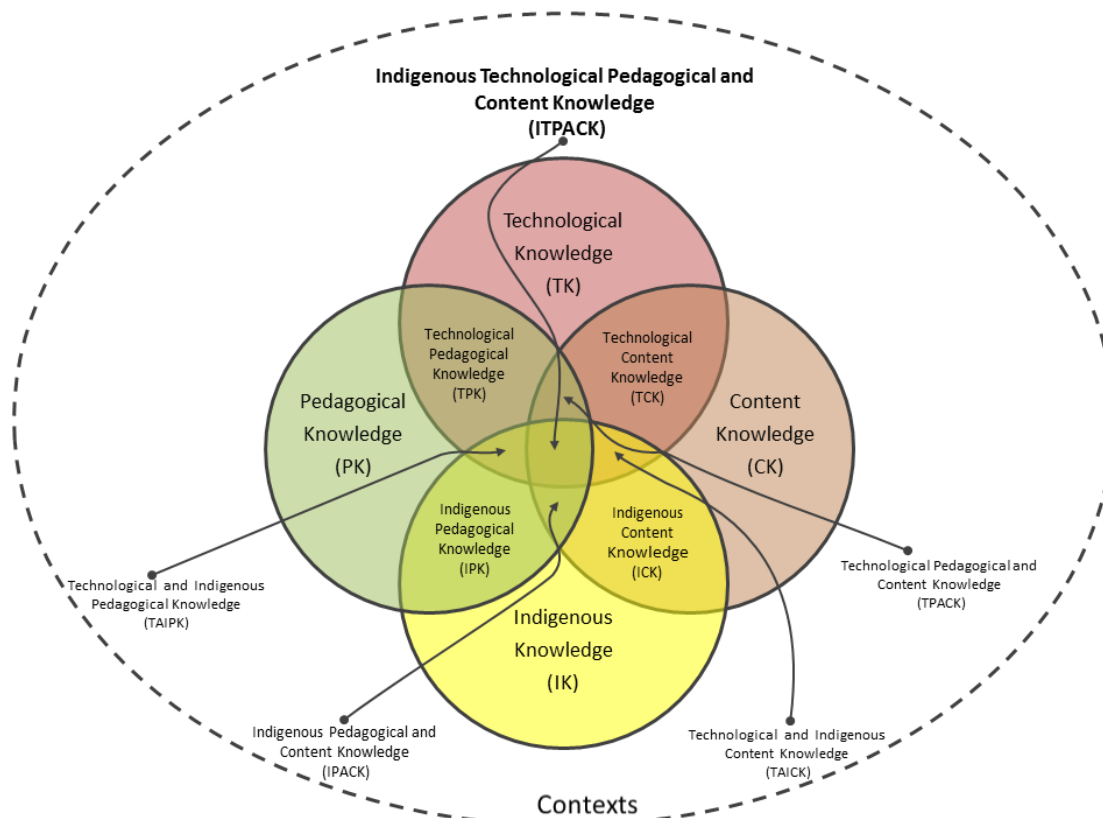
Figure 5: I-TPACK

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

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 reowned 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

Agrawal, A. (1995). Dismantling the divide between indigenous and scientific knowledge. *Development and Change, 26*(3), 413–439.

Angeli, C., & Valanides, N. (2009). Epistemological and methodological issues for the conceptualization, development, and assessment of ICT-TPCK: Advances in technological content knowledge (TPCK). *Computers & Education*, *52*(1), 154–168.

Dalvit, L., Murray, S., & Terzoli, A. (2008). The role of indigenous knowledge in computer education in Africa. In M. Kendall & B. Samways (Eds.), *Learning to live in the knowledge society, Vol. 281 of IFIP International Federation for Information Processing*, Springer Boston, pp. 287–294.

Koehler, M. J., & Mishra, P. (2008a). Introducing technological pedagogical content knowledge. *Annual Meeting of the American Educational Research Association, 32*(2), 1–16.

Koehler, M. J., & Mishra, P. (2008b). *Introducing TPCK* (pp. 3–29). Routledge.

Marais, H. (2011). *South Africa pushed to the limit: The political economy of change*. UCT Press.

Mishra, P., & Koehler, M. J. (2006).Technological pedagogical content knowledge: A framework for teacher knowledge. *Teachers College Record,* 108(6), pp. 1017–1054.

Mphahlele, E. (1997). Living writers, living culture. *Scrutiny2: Issues in English Studies in Southern Africa, 2*(2), 40–42.

Ntuli, P. P. (1999).The missing link between culture and education: Are we still chasing gods that are not ours? In Malegapuru, W. M. (Ed.), *African renaissance: The new struggle* (pp. 184–199). Tafelberg Publishers

Schumacher, J., & Feurstein, K. (2006). Living labs – the user as co-creator. *Methods*.

Sesame Workshop. (n.d.). Retrieved 13 March 2013 from http://www.takalanisesame.com/about.html

Shulman, L. (1986). Those who understand: Knowledge growth in teaching. *Educational Researcher 15*(2), 4–14.

Spaull, N. (2012). *Education in SA: A tale of two systems*. Retrieved 21 February 2013 from http://www.politicsweb.co.za/politicsweb/view/politicsweb/en/page71619?oid=323272&sn=Detail&pid=71616

Sutinen, E., & Tedre, M. (2010). ICT4D: A computer science perspective. In T. Elomaa, H. Mannila & P. Orponen (Eds), Algorithms and applications, Vol. 6060 of *Lecture Notes in Computer Science* (pp. 221–231). Springer Berlin/Heidelberg.

United Nations Educational, Scientific and Cultural Organization (UNESCO) (n.d.). Indigenous Knowledge and Sustainability. Retrieved 10 March 2012 from http://www.unesco.org/education/tlsf/mods/theme_c/mod11.html

Woytek, R., Gorjestani, N., & IK Initiative Team. (1998). *Indigenous knowledge for development: A framework for action*. Technical report, World Bank.

Zembylas, M. (2009). ICT for Education, Development, and Social Justice: Some theoretical issues. In Vrasidas, C., Zembylas, M. & Glass, G.V. (Eds), *ICT for Education, Development, and Social Justice*, Information Age Publishing Inc, pp. 17–29.

# Biography

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