Editorial for the Special ICEL Issue of EJEL

The papers in this issue of EJEL have been selected from those presented at the 8th International Conference on e-Learning, which was held in June this year at the Cape Peninsula University of Technology in Cape Town, South Africa.

The research presented at the conference represented a diverse range of topics and this is reflected in the papers that have been selected for this issue of the journal. A feature of the issue is the role of e-learning and blended learning in the developing world.

The paper by Susan Crichton looks at the design of learning systems and focuses on the issues involved in developing Innovative Learning Centres (ILC) in challenging contexts. In particular this research describes the thinking behind the ILC concept and the value placed on the cultivation of partnerships among institutions in order to build models of practice and create places for pedagogical exploration and educational change.

The second paper by Johannes Cronje is a reflective piece that gives a comprehensive overview of research into computers and education in Africa that has been undertaken at the University of Pretoria since 1995. It explores the patterns that have emerged and it is interesting to see that key areas of interest over the past 15 years include “Didactic/Pedagogical Issues and Teaching/Learning Strategies” as well as “Architectures for Educational Technology Systems”. In addition to analyzing the past the paper suggests research direction for the future.

The paper by Gachago et al is about digital storytelling and counter-storytelling. Drawing on theories of resistance, counter-storytelling and multimodality, the study set out to explore five pre-service teacher educators’ perceptions on types of resistance, functions of counter-storytelling and considered what a multimodal analysis could reveal about students’ relationship between modes, learning and identity.

Kebaetse et al have tackled the topic of integrating eLearning to support medical education at the New University of Botswana School of Medicine. The authors critically reflect on the strategies used to implement e-learning and highlight some of the challenges experienced and, as this is an ongoing project, they acknowledged that the evaluation of efficacy, effectiveness and cost-effectiveness of the elearning agenda is important to follow.

Kruger and Bester’s paper on mobile learning looks at an interesting project to use e-textbooks and tablet computers to deliver course material with the aim of improving the quality of education by transforming outdated teaching and learning practices.

The paper by Brown Bully Onguko looks at a sustainable blended learning approach to Teachers’ Professional Development. The approach discussed in the paper looks at how to develop and then work with regional experts to create blended learning content, using appropriate technology and building content repositories that can be sustained over time.

Penman and Thalluli present a model to improve the learning experiences of science students and increase student retention and success rates. The paper investigates the introduction of a range of
online activities including electronic learning communities, online self-assessments, a virtual classroom, and social media to offer practically oriented science learning to urban and regional science students.

The final paper in this issue by Tshabalala et al looks at the implementation of blended learning at a developing university in South Africa. Using a technology acceptance model the paper presents a case study that investigates the perceptions of academic staff about blended learning and identifies some of the challenges that face them in the adoption of blended learning.
Leapfrogging Pedagogy: A Design Approach to Making Change in Challenging Contexts

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Abstract: At a time of substantial change, globalization, and ubiquitous access to information, educators struggle to change even the most basic aspects of their classrooms. This is especially true for those in challenging contexts where many perpetuate the “mind numbing” practice of rote instruction. This paper describes a collaborative partnership among academics in Canada and East Africa as they develop Innovative Learning Centres (ILC) in their respective institutions to leapfrog pedagogy in imaginative ways, drawing on experiential learning and the Maker Movement in a studio based learning environment.

Keywords: Transformative pedagogy, Maker Movement, design thinking, studio based learning, challenging contexts

1. Background

While educators have always worked in challenging times and varied contexts, it is acknowledged that currently society is in an unprecedented time of substantial change due to a variety of circumstances including globalization and ubiquitous access to information. As other sectors seem to adopt innovative practices and embrace change, educators tend to struggle to change even the most basic aspects of classroom practice, and it is well recognized that teachers typically teach in the ways in which they themselves were taught (Britzman, 1991). As Dewey noted, “If we teach today as we taught yesterday, we rob our children of tomorrow.”

Teachers working in challenging contexts face even a more daunting task. Crichton and Onguko (2013) define challenging contexts as settings in which individuals, due to a variety of circumstances, conditions or environmental constraints, do not have

- Access to consistently available and affordable electricity
- Access to reliable, unfiltered or uncensored Internet
- Access to previous formal learning and / or opportunities for ongoing formal learning that support individual learning needs
- Access to non-formal, yet appropriate learning opportunities
- Access to or participation in learning activities due to cultural or religious reasons
- Access to transportation and mobility
- Access to prior learning
- Access to other situations linked directly to poverty (health, fees, low wages, inappropriate clothing, etc.).

Unfortunately, that list is not exhaustive as additional challenges surface with climate change, social / economic upheaval, and other geographic / social contextual factors. In a recent conversation with educators in Mombasa, Kenya¹, additional access issues were identified. These include a lack of access to:

¹ The author shared the initial list with students in a certificate course offered by Aga Khan University, Institute of Educational Development, East Africa. Students were then asked to brainstorm conditions / constraints that should be added.

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The identified conditions are all too commonly experienced in almost all parts of the world today with varying degrees of impact or intensity. The term challenging contexts is used throughout this paper, suggesting it is much more respectful and specific of the people and their situations than more commonly used labels such as developing countries or third world environments. Challenging contexts suggests these situations exist, in varying degrees, in neighborhoods from New York to London, Karachi to Mombai, from rural settings globally, and the ever increasing refugee camps where generations are forced to live out their lives.

Addressing the challenges identified above requires thoughtful, considered initiatives that first recognize the specificity of constraints and then attempt to ameliorate them by providing simple, relevant, contextual solutions that minimally disrupt the peoples’ lives and involve all stakeholders in design. This approach aligns with Schumacher’s definition of appropriate technology – an intervention that is minimally disruptive but does include the end users in the design rather than delivering a pre-done, out of context solution on the people.

A recent article entitled “How Jeffrey Sachs Failed to Save Africa” is a case in point (2013). Wente reviews Nina Munk’s recent book, The Idealist: Jeffrey Sachs and the Quest to End Poverty (2013). Munk explains, “Recent history is littered with the wreckage of grand plans to save Africa. So why should we care about another? ... Promises that can’t be kept invariably result in disappointment, cynicism and donor fatigue.” Munk’s criticism is directed at Sach’s Millennium Village Project, which she brands as too technocratic and prescriptive. Wente’s review departs from Munk’s thesis by concluding, “... things are gradually improving. And African themselves are increasingly taking the lead.” This paper builds pragmatically on that hope, suggesting that it is through collaborative approaches with academics and educators, local and global, a better future for education can be imagined that is inclusive, respectful, and contextually relevant - one that is actually developed within the challenging context itself.

2. Introduction

Sir John Daniel (2010) explains that education in the 21st century should lead to the “nurturing of human capabilities that allow [students] the freedoms to lead worthwhile lives” (p. 6). He stressed that it should not merely train individuals to become the human capital required for economic production, recognizing the importance of fostering personal agency, creativity, imagination, and sense of hope and possibility. Further, he suggests contemporary education must address the issue of school retention and quality by working to enhance student engagement and make classwork more relevant and interactive.

Increasingly, educators are learning that student engagement is more than time on task and academic success. In 2007, the Canadian Education Association (2013) initiated in a multi-year research study to explore student engagement entitled, What Did You Do in School Today? The study gathered information from approximately 60,000 students in more than 18 schools districts across Canada. Specifically, the study popularized a multidimensional framework of student engagement that includes social, institutional and intellectual engagement. The dimension of intellectual engagement includes two measures: 1) Intellectual Engagement (a composite of rigor, relevance, interest and motivation, and effort) and 2) Instructional Challenge (a summary of students’ experiences of learning based on Csikszentmihalyi’s theory of Flow).

Findings suggest educators are generally comfortable in their understandings and practices concerning academic engagement (the learning of skills), but they are less skilled in enacting intellectual engagement as
expressed in instructional challenges that foster curiosity and imagination. These findings are significant for this paper as this gap is especially present in schools located in challenging contexts where one typically finds teacher directed, rote learning. Social engagement and active learning are typically missing in those schools as teachers wrestle to simply cope with overcrowded conditions with few, if any resources or supports.

Therefore, the overarching question guiding the work shared in this paper is how might the development of an Innovative Learning Centre (ILC) in an Institute of Educational Development or a Faculty of Education, help educators in challenging contexts improve pedagogy; foster academic, intellectual and social engagement; and encourage teachers and their students to escape from the “deadening tradition of rote learning” (Daniel, 2010, p. 31). A related question is how might a change in pedagogy help educators imagine contextually and culturally relevant innovations that might improve classroom practice in both contexts?

This paper describes an ongoing, collaborative partnership among academics as they develop an Innovative Learning Centre (ILC) in each of their two institutions. The author designed the initial ILC at the University of British Columbia and is currently working with her former doctoral student and his colleagues to develop an ILC in his institution within the Institute of Educational Development – East Africa (IED, EA), which is part of the Aga Khan University.

Crichton (2012) explains the role of an ILC in her institution is to bring academics, educators, and industry together to imagine and create transformative pedagogical practices, using appropriate technologies in a design based, research informed, studio based learning environment. In challenging contexts, she suggests an ILC could be used to leapfrog existing paradigms constraining innovative practice. Leapfrogging, in the context of sustainable development, is a term used to describe the accelerated development of an intervention by “leaping over” conventional approaches and/or technologies and moving directly to a more appropriate, and often more advanced, one. An often-cited example is found when regions skip over the installation of landline telephony and move directly to mobile phone connectivity, leapfrogging the lack of phone access by embracing the newer, more appropriate mobile phone solution.

A pedagogical example of leapfrogging in challenging contexts would be the adoption of an inquiry approach to teaching and the authentic use of the environment as a teaching resource. Rather than spending time and money trying to catch up by equipping schools in configurations favouring a teacher-centric delivery, the ILC suggests finding regional partners and developing resources, tools and strategies that address contextual issues with local solutions. This approach would help leapfrog traditional classroom practices, both the pedagogy and physical design of the actual learning environment, allowing educators to embrace the change suggested in the literature, including UNICEF’s Child-Friendly School (CFS) standards (Irvine & Harvey, 2010).

CFS is one example of an educational reform initiative developed for challenging contexts, and while there are many others, its standards provide a valuable framework for the development of an ILC in East Africa. The CFS standards were developed to offer specific ways to accomplish the inter-related six Education For All dimensions expressed in the United Nations Millennium Development Goals (United Nations, 2010):

- Expanded early childhood care and development (ECCD) provisions;
- Universal access to and completion of primary or basic education;
- Improved levels of learning achievement;
- Reduction of adult illiteracy;
- Expanded basic education and training for youth and adults; and
- Enhanced life-skills for sustainable development through traditional and modern communication (p. 3).
Child-Friendly Schools encourage a strong connection between schools and the communities they support by providing greater access to an inclusive learning environment. They provide a “child-centred pedagogy fostering more independent thinking, entrepreneurial skills, and professionalism among teachers and attention to the all-round development and welfare of individual children” (p. 4).

The United Nations recognizes that achieving the CFS standards of practice will not be easy, and more tacit agreement in principle rather than meaningful actual practice will probably happen. However, universities must play a major role in championing these standards by acknowledging them in their curricula and developing innovative learning centres where faculty, students, and other participants could come and imagine, develop, test, and try new ideas, tools and approaches. Interestingly, the seven quality areas identified by the CFS initiative create a structure for thinking about ILC projects by questioning how educators might:

- Create friendly, rewarding and supportive learning atmospheres in their schools
- Support cooperation and active learning as an integral approach to teaching and learning activities
- Ban physical punishment and violence and institute positive ways of interacting
- Stop bullying, harassment and discrimination
- Develop creative activities and imaginative learning opportunities
- Connect school and home life by involving parents in school activities
- Promote equal opportunities and participation in decision making for all members of the school community – school leaders, teachers, students and parents (p. 5).

Developing viable answers to these quality areas, that are both sustainable and contextual relevant, will take creative thinking, imagination, and design thinking. Educators know there is no shortage of policy documents, initiatives, and good ideas about education reform; what is in short supply are innovative practices that are sustainable, scalable and relevant to educators in challenging contexts. The innovation behind the ILC approach rests in the collaborative partnership of academics, educators, and industry in a reciprocal and iterative approach to the design and development of educational tools, software and interventions. This partnership can help inform policy and product design by situating the work within school contexts and collaborating with industry in their early stages of product design. Post secondary institutions, specifically those with a Faculty of Education, are uniquely positioned to facilitate an interprofessional dialogue among partners, drawing the best from each sector. An ILC can bring these individuals together to imagine the future of learning by offering and co-creating images of changed practices – both the physical configuration of learning spaces as well as innovations in the design and development of culturally relevant / respectful resources and tools.

While research suggests educational reform and school change do not happen easily, and “there is no easy science or set of rules for enabling education transformation,” (Nicolai, 2009, p. 29) design thinking might offer promise. Design thinking is “… a discipline that uses the designer’s sensibilities and methods to match people’s needs with what is technologically feasible and … viable … ” (Brown, 2013). The Institute of Design at Stanford University is leading much of the innovation around design thinking through the establishment of their design school (http://dschool.stanford.edu/) and the development of significant resources such as dSpace (Witthoff & Doorley, 2012), which focuses on the physical configuration of rooms and equipment to foster collaboration and creativity as well as methods to facilitate innovative thinking (Stanford University Institute of Design, 2013).
This paper suggests that if we want to change educational practices, we need to think and act differently, to design a preferred future for educators and their students. As Einstein (1931) aptly said, “The definition of insanity is doing the same thing and expecting a different result.”

3. Thinking behind the ILC Design

In Fall 2011, the plan for the initial ILC, located at the University of British Columbia’s Okanagan campus (http://blogs.ubc.ca/centre/), was approved. The ILC was granted university centre status so it would be eligible for external funding and a director could be appointed and an advisory committee formed. The ILC was built on the principles guiding 21st century learning (Trilling & Fadel, 2009), studio based learning (Lackney, 1999), and Dewey’s original work describing experiential learning (1938).

Dewey argues for “the importance of the social and interactive processes of learning,” noting the challenge is to create learning experiences that are “fruitfully” organized in a progression that guide students’ learning. He states “Educators must think about the experiential continuum—[a] continuity of experiences” (p. 32). Dewey goes on to critique traditional school structures, suggesting they are “insular environments” that rarely interact with the world and therefore lack the potential for an understanding of the world and a context for richer learning opportunities, noting that everything must have a context in order to be an educational experience.

Setting the stage for our contemporary thinking about authentic learning and active engagement 75 years ago, Dewey suggested students must feel a sense of purpose in their learning to avoid mental slavery, explaining there “no defect in traditional education greater than its failure to secure the active cooperation of the pupil in construction of the purposes involved in his studying” (p. 28). Dewey was particularly concerned with the role of the educator in providing the continuity of experiences required for a thoughtful education, and he felt the difficulty in doing so would rest with the educator’s ability to continually adapt subject matter to the growing sphere of individual experiences as students progress. Of course, this concern is addressed beautifully by Vygotsky’s notion of the zone of proximal development (1978) which suggests students can do more with the guidance / scaffolding of a timely mentor with experience.

Contemporary writers such as Trilling and Fadel (2009) suggest learners need opportunities to learn in authentic and social settings; create mental models, work with their multiple intelligences, and develop internal motivation. They draw on brain research, suggesting it offers an important revolution in our understanding of how people learn” (p. 30). They describe authentic learning as the context or the condition in which students learn, noting “the people, objects, symbols, and environment, and how they all work together to support are much more influential than previously thought” (p. 31). They suggest students need “more real-world problem solving, internships or apprenticeships in real work settings, and other authentic learning experiences that make learning last and be useful” (p. 31).

The creation of mental models allows learners to evolve their thinking over time. While initially a child might consider the boundaries of their world to be their own neighborhoods, in time, through the use of tools like Google Earth, maps on school walls, or globes, they can begin to understand their place in a larger global community. It is through the creation of these models that we use our learning to shift our thinking and expand our understanding through both virtual and physical representations. Using visualization software (i.e. Google Earth, Gephi - https://gephi.org), emerging multimedia tools, and physical models made from found objects in the natural environment, we support the development of our multiple intelligences when we personalize representations of our individually constructed learning. Gardner’s work (1983), while continually mis-referenced to suggest that we have one dominant intelligence, explains the need to hone our multiple and varied intelligences to support our diverse learning styles and learning activities. Use of Universal Design for Learning approaches to support students as they develop their own knowledge are added by the thoughtful and appropriate uses of technologies (Rose, Meyer, Strangman, & Rappolt, 2002).
Trilling and Fadel (2009) note internal motivation is critical for active and engaged learning, suggesting it is fostered when people, “have an emotional connection to what is being learned – a personal experience or question” (p. 33). Increasingly we are seeing emotional connections being supported through online social interaction, but we need to remember that in-class conversations, discussion groups with community experts and elders, promote active, engaged learning, both informally and formally.

Drawing on Lackney’s description of a studio based learning environment, the ILC at UBC hosts a physical “classroom” designed to disrupt educators’ notions of what a learning environment might look like. The space is called a learning lab rather than classroom to further signal changed practice. While there is space for 40 people, there are NOT 40 spaces available for everyone to be doing the same thing. Please see Section 1.6.1 Work Space Layout for Learning Lab for a more detailed description and the ILC blog (http://blogs.ubc.ca/centre/2013/08/23/a-little-tour/) for images of the actual space.

As stated earlier, the ILC is built on the principles of experiential learning. ILC is a studio based learning environment that encourages experimentation and engagement with materials and resources to make personal meaning, and by inviting academics, educators, and industry into the learning space, the authentic, contextual learning that Dewey, Papert, Trilling and Fadel and others describe is possible. Those working in the ILC are encouraged to tinker and explore together and design new ways of knowledge building. John Seely Brown describes tinkering as constructing / playing / wrestling with objects by appropriating, transforming and personalizing them for one’s own learning and practice (Brown & Duguid, 2000). Inherent in the ILC design is a space to construct – build, collaborate, modify, and test ideas. It is designed to draw on the best of Papert’s notions of constructionism (Resnick, 2012). “In Papert’s view, children should be able to design, create, and express themselves with new technologies” (p. 42). Inexpensive alternatives to computers, such as Cambridge’s Raspberry Pi (Mullins, 2012) allows children to do more ‘than just interacting with animations, games, and simulations, children should learn to program their own animations, games, and simulations—and, in the process, learn important problem-solving skills and project-design strategies” (Resnick, 2012, p. 42). Other promising technologies include Arduinio (http://www.arduino.cc/) and littleBits (http://littlebits.com/) - both allow children and educators explore robotics, circuits, and design thinking with minimal equipment and prior knowledge.

The ILC also incorporates ideas from the Reggio Children’s Network that offer ways of thinking about one’s learning about learning in terms of authentic questioning, documentation and exploration of the local environment (Reggio Children, n.d.). While the Reggio approach uses digital tools to support children’s work and create ways to document learning in significant and very visual ways, it fundamentally provides support for using one’s environment as an additional teacher and rich, place based resource for teaching and learning.

The recent enthusiasm surrounding the Maker Movement (Martinez & Stager, 2013a) offers further evidence of / opportunities for experiential, hand on learning. The maker movement “overlaps with the natural inclinations of children and the power of learning by doing. The active learner is at the center of the learning process, amplifying the best traditions of progressive education” (Martinez & Stager, 2013b), and at the time of writing this paper, the ILC has been funded to host one of the first Maker Days for educators.

4. One Design – Two Contexts

Imagining a studio based design space within a Faculty of Education is a lovely challenge. To get it right, one must consider the types of environments in which creativity and imagination might be fostered while considering the types of pedagogical approaches that might enable learners from various contexts and backgrounds to come together and collaborate. Since the very beginning of the design process for the ILC at UBC O, the physical space has been conceptualized as a learning lab – a place for people from a variety of ages and stages and a range of professions, vocations, avocations and experiences to come together and form a knowledge building collective for innovative thinking. In conversations with the very supportive dean of the
Faculty of Education, it was agreed that in a time of substantial change, globalization, and ubiquitous access to information faculties of education needed to step up and lead changed pedagogy and model alternative and innovative learning environments. This approach parallels Thomas and Seely Brown (2011a,b) call for a new culture of learning based on the following assumptions:

- The world is changing faster than ever and our skill sets have a shorter life
- Understanding play is critical to understanding learning
- The world is getting more connected that ever before – can that be a resource?
- In this connected world, mentorship takes on new importance and meaning
- Challenges we face are multi-faceted requiring systems thinking and socio-technical sensibilities
- Skills are important but so are mind sets and dispositions
- Innovation is more important than ever – but turns on our ability to cultivate imagination
- A new culture of learning needs to leverage social and technical infrastructures in new ways
- Play is the basis for cultivating imagination and innovation.

Play and tinkering are the core business of the Innovative Learning Centre. If academics, both faculty and graduate students; educators, both preservice and K-20, working in both formal and informal settings; and industry are to thrive, they must be together. To quote Einstein (1931), “We can’t solve problems using the same kind of thinking we used when we created them.” Using the Child-Friendly School’s seven quality areas as a starting point for design thinking, those working in the ILC can begin to create tangible options to move beyond rote teaching and begin to support inspired and engaged thinking and learning.

The ILC contains spaces to support the creative design cycle – imagining, creating, playing, sharing, and reflecting … an iterative, Möbius strip of design thinking. The ILC has both a physical and virtual space. The virtual space will continue to morph and grow, and currently exists as a blog (http://blogs.ubc.ca/centre/) and a Twitter account (#UBCILC). Apart from the learning studio, there is a breakout room that accommodates up to eight people and can be used to host meetings and collaborative sessions with industry and education colleagues. Additional space is required for storage of IT equipment as the success of the ILC is its ability to be “off the grid” of the university’s network regulations and standardized software and hardware requirements.

While the learning lab incorporates spaces to support the design cycle (see Figure 1), it is recognized that users of this space will work where they feel most comfortable and the most appropriate tools are available. To paraphrase Sullivan’s notion, form follows function and the thinking behind the design of the ILC suggests physical spaces can invite creativity and imagination. Based on comments from users of ILC at UBC, the physical space does encourage changes practices, but individual instructors are the gatekeepers. Surveys have been given to groups using the ILC for the last six months. The majority of instructors / facilitators have embraced the affordances provided within the ILC, and one instructor has wrestled to re-arrange the furnishings to resemble what she termed “a real classroom.” A significant finding from this initial study of 300 users is access to the space must be voluntary, as instructors assigned to the space may not be prepared to change their practices to function within a studio-based environment. What was confirmed by the survey findings was that an entirely different pedagogical approach needed to be developed to encourage risk taking and creativity and create learning opportunities that fostered the creative design cycle illustrated in Figure 1.

In December 2012, the design for a second ILC, situated in Aga Khan University - Institute of Education Development (AKU,IED) in Dar es Salaam, Tanzania, was proposed. This paper reports on the design and development of the two ILC spaces, focusing on the Tanzanian model and will share initial thoughts as to how the ILC might support academic, education, and industry partners leapfrogging current practices and develop learning innovations to encourage pedagogical change in challenging contexts.
4.1 Work Space Layout for Learning Studio

Figure 1: Creative Design Cycle - ILC

Figure 1 suggests five specific areas within the learning lab. The area to encourage *Imagination* should occupy about a quarter of the room. It should be furnished with soft seating to support informal conversations. Where possible, the furniture should be locally sourced and easily moved to accommodate different activities and groupings. Cushions should be comfortable and made from local fabric to set a regional tone for the room (e.g. in Tanzania local wooden furniture covered with *kitenge* cloth). This area is designed for approximately eight people at a time. Writeable walls should surround the seating area so people can brainstorm and create images their ideas. These walls can be created using chalkboard over existing smooth walls. Graphic facilitation techniques should be taught to foster visualization skills, and coloured chalk should be provided to make the illustrations vivid and dramatic. People can use their cell phone cameras to capture / document their ideas and share them among the group.

The *Collaboration* area utilizes the majority of the learning lab. There could be up to seven wooden tables, and stools rather than chairs should be used to encourage people to get up and move around – the seating should not be too comfortable or too fixed. The tables can be pulled together for large collaborative activities or kept separate, seating groups of three people. The addition of a white painted wall in this area serves as the projection screen, while the bulk of the wall area surrounding this area, as described in the Imagination paragraph above will be painted black so people can write on it with coloured chalk.

The area for *Creating* occupies one wall of the studio space. There should be four wall mounted computer stations (computers with large screen displays). The counter surface should be continuous so it is also a workspace. Wireless mice and keyboards are required for easy of sharing amongst participants and to support the use of the table top for project activities.

*Tinkering / testing* can be done using relatively easily to build iClass table ([https://www.cushing.org/iclass](https://www.cushing.org/iclass)) or gesture table ([http://blogs.ubc.ca/centre/2013/04/23/gesture-table/](http://blogs.ubc.ca/centre/2013/04/23/gesture-table/)) to support the use of a Leap Motion controller. An interactive table can run on open source software or Air Space apps and can be easily made with fairly reasonable components. It is a horizontal version of an interactive whiteboard. Four people can sit around the table to tinker and test their ideas and work.

Of course, *Play* will take place throughout the room. It is assumed that people will move from location to location depending on the aspect of a task on which they are grappling. Obviously, faculty using this learning lab space will need to change their pedagogy to embrace the notion of knowledge building and creative design for learning.

The learning lab is design to accommodate forty people which is consistent with the stated class size of many K – 12 classrooms. While it is well known that many classrooms in challenging contexts may have upwards to 60 or 70 students, the ILC is designed to accommodate 40 people with the potential to have small stools and floor seating on mats to accommodate more. The learning lab is to be used to imagine innovations in pedagogy and
model changed practice. It is designed with the belief that members of AKU, IED community can transfer best practices from the ILC into their work with teachers and educators in the field.

5. Next Step – How Will We Know If the ILC Design Has Made a Difference?

It is still early days for both the ILC designs. The ILC at UBC is underway. A variety of industry partners are currently working with academics and educators to design apps and web resources for Math, Physics, Social Emotional Learning, and holistic assessment. At the time of writing this paper, the learning lab at UBC has been in use for two academic semesters. Users of the UBC ILC have signed ethical consent forms so their activities, challenges and approaches can be studied, and photographs have been taken of the various furniture configurations as no single instructor or group tends to use the space in exactly the same way.

The basic design of an ILC for East Africa has been discussed with academics at IED and in a seminar in June 2013 with graduate students there. There was great enthusiasm amongst the students who felt the learning environment would foster creativity and would help them to creative meaningful learning resources for their colleagues and students. The discussions also introduced students and faculty to the Maker Movement, exploring ways in which a focus on “doing” could help recapture the importance of traditional ways of knowing and doing. Using the phrase “Mafundi wako juu,” we modeled simple passive solar water heating to improve food safety / handling and basic sanitation. As one student stated, learning about these ideas has actual application - "I have been thinking of how I can use solar to heat water in my place. This is a project that I will implement when I go back to my place."

A grant funded by the International Development Research Centre (IDRC), Association of Colleges and Universities in Canada (AUCC), and the Canada/Africa Research Exchange (CAREG) was received September 2013. These funds will allow faculty in Canada and East Africa to collaborate, with limited funding being provide to help equip the ILC in East Africa. The research proposed in the grant will explore the efficacy of the ILC design to build capacity and support the development of local / regional pedagogy and content that help educators to leap frog current practices experienced in many challenging contexts with Tanzania. It will follow an iterative design research approach, including a review of the literature; visits to sites recognized for supporting innovation, creative and / or knowledge-building; analysis of online collaborations with colleagues; documentation of workshop activities with educators; and maintaining of researcher field notes. Argyris and Schön’s (1978) gap analysis approach was used to analyze findings and inform the iterative design of both ILCs, and semi-structured interviews using a phenomenological approach will be conducted with participants.

6. Conclusion – The Start of the Beginning

This paper shares the thinking behind the ILC concept and the value placed on the cultivation of partnerships among institutions in order to build models of practice and create places for pedagogical exploration and educational change. The interactions and knowledge sharing among faculty at Aga Khan University, Institute of Educational Development and the University of British Columbia Okanagan has been essential, and it has been both collaborative and collegial.

Faculty members have had much to share including their lived experiences, research approaches and experiences, varying understanding of contexts, and professional networks. What brought the colleagues together five years ago was an understanding of the potential and promise of appropriate technologies to support learning; what keeps them together is a belief that “Imagination is more important than knowledge. For knowledge is limited to all we now know and understand, while imagination embraces the entire world,

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2 Literally translated as Fundis trades people) rock!
and all there ever will be to know and understand” (Einstein, 1931). Both partners, UBC and IED, EA recognize their equal and essential roles in the work and design.

The Innovative Learning Centre is designed to foster change and leapfrog the existing practices found in so many schools. The one planned for East Africa will contextualize the concept, drawing heavily from UNESCO’s Child-Friendly School initiative as well as other projects and ideas relevant to its context. Therefore, the overarching question guiding the work shared in this paper is how might the development of an Innovative Learning Centre in both an Institute of Educational Development and a Faculty of Education can help educators in challenging contexts improve pedagogy; foster academic, intellectual and social engagement; and encourage teachers and their students to escape from the “deadening tradition of rote learning” (p. 31). A related question is how might a change in pedagogy help educators imagine contextually and culturally relevant innovations that might improve classroom practice in both contexts?

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An African Research Agenda for Computers in Education

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Abstract: This article presents an overview of research into computers and education undertaken at a the University of Pretoria since 1995. It seeks to explore the patterns that have emerged and to indicate potential directions for future research. In response to a call for research in the field to be taken seriously the article identifies the main themes that have been researched over fifteen years. The analysis shows that the main themes addressed are “Didactic/Pedagogical Issues and Teaching/Learning Strategies” and “Architectures for Educational Technology Systems”. Finally the paper recommends the development of a taxonomy of terms to be used in the classification of research on e-Learning.

Keywords: Didactics; Pedagogy; Teaching/Learning Strategies; Architectures for Educational Technology Systems

1. Introduction

This article responds to Simsek’s (2005) research into Perceptions and Opinions of Educational Technologists Related to Educational Technology and the suggestion that “findings related to the issue of associating the field of educational technology with specific subject areas in international area can provide various perspectives to those who are performing their careers in the field of educational technology” (Simsek, 2005, p.181). The research reported here classified the keywords used by graduate students at the University of Pretoria from 1995 to 2010. The canon of reported research that forms the basis of this article consists of masters’ theses and half-theses, as well as doctoral dissertations prepared under the supervision or co-supervision of the author. The aim of the article is to explore the patterns that have emerged over the past fifteen years and to consider how these patterns constitute a research agenda. This article is the first step in an attempt to take a serious look at the way in which a particular longitudinal cohort of students has been researching the field. This article is intended to present to the readers of this journal a brief summary of work that may resonate with their own research.

The main question driving this study is “What research agenda, in terms of educational technology and e-Learning, has emerged at the University over a period of fifteen years? This question was refined by two sub-questions:

▪ How can the keywords extracted from 15 years of research be classified into distinct categories regarding educational technology and e-Learning?
▪ What is the range of themes that were investigated by the students under each category?

The rationale for this research is that it should contribute to our understanding of the field of e-Learning by presenting the research agenda of a select group of students in an over-arching design research context, while at the same time resonating with the special issue on “Grand challenges and Research Directions in e-Learning of the 21st Century (Educational Technology & Society 16(2)).

The research falls into what Tom Reeves calls the product of “isolated researchers, most often doctoral students and new faculty members, who conduct individual studies that are rarely linked to a robust research agenda” (Reeves, 2001, p.4). Traditionally in the South African university system a student is assigned a single supervisor or advisor, rather than an advisory committee as is done in the USA. Students are by the head of the academic department. In the cases described here most students were recruited by the supervisor who then requested the departmental head to assign them, or the students requested the head to assign the particular supervisor. Students usually have a free choice of their topic, or negotiate the topic with the

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supervisor, so a pre-determined research agenda is hard to achieve. This article thus is an \textit{ex post facto} attempt at extracting a research agenda to see what the implicit connecting threads may have been, so that a more robust research agenda might be suggested.

2. Conceptual framework

This research is inspired by Reeves’s (2001) explanation of socially responsible research, as well as Reeves, Herrington & Oliver’s (2005) description of design research. For research to be socially responsible, it needs to be concerned with both a search for understanding, and with usefulness (Stokes, 1997 – see Figure 1).

![Figure 1 Pasteur's quadrant – Stokes, 1997](image)

For Reeves, Herrington & Oliver “…at some level, all instructional technology research can be said to focus on questions of how people learn and perform, especially with respect to how learning and performance are influenced, supported, or perhaps even caused by technology” (2005, p. 100-101). They further identify the following six characteristics of design research:

- A focus on broad-based, complex problems critical to higher education, focus on broad-based, complex problems critical to higher education,
- The integration of known and hypothetical design principles with technological affordances to render plausible solutions to these complex problems,
- Rigorous and reflective inquiry to test and refine innovative learning environments as well as to reveal new design principles,
- Long-term engagement involving continual refinement of protocols and questions,
- Intensive collaboration among researchers and practitioners, and
- A commitment to theory construction and explanation while solving real-world problems.

(Reeves et al., 2005, p. 103)

3. Method

This article is a subjective reflection on research done in a rapidly-changing field. As such it falls into Reeves’s (2001) postmodern paradigm. The research aim was to explore rather than to describe. It is hoped that the topography that emerges may be useful for future researchers to develop an understanding of the emerging themes that are uncovered from this exploration. The author’s role in this research is that of a reflective practitioner, reflecting upon the outcome of research supervision over a number of years. As such the author
acknowledges his position as a source of bias. Nevertheless, the goal is not to defend any position the outcome of the research does not affect the author in any way. A further potential limitation of this research is that it covers a limited cohort all supervised, or co-supervised by the same person. Once again, this is no different from teacher-researcher who would research the response of an undergraduate class that they may have taught.

The research procedure was to do a search through the University’s digital library for half theses, theses and dissertations in the field of Educational Technology. Once that was done the keywords and abstracts were copied into a spreadsheet to enable further classification. Two different methods were used to answer the two sub-questions.

To answer the first question, “how can the keywords extracted from classified into distinct categories regarding educational technology and e-Learning?” the 525 keywords supplied by the students in their theses and dissertations were sorted alphabetically and grouped into 21 groups of similar themes.

Firstly the students did not assign the same number of keywords each. Some students assigned three, others as many as seven. The unequal distribution of keywords meant that the picture that was being coloured in, was the set of themes rather than the actual studies conducted by the students. The unit of analysis, in other words, is the keyword, not the thesis or dissertation. Essentially the question says, given an unlimited choice of number of keywords, what keywords were selected, and how can these keywords be grouped?

Secondly, the students could use any keywords they liked, which meant that the keywords did not necessarily line up with any pre-determined code book. The matter was further complicated by relatively neutral words such as “Internet”, “computers” or “technology”. These words were put under the closest corresponding theme. “Internet” went to “Web-based Instruction”, while “computers” were classified under “Interactive learning environments”. In cases where it was hard to decide where best to put a certain word the abstract of the thesis was consulted. A second round of coding took place where topics with fewer than 35 assigned keywords were removed and the keywords were reassigned to the next closest theme. It must be stressed here that the purpose of the exercise was to identify a number of themes, and not to develop a quantitative match of keywords and topics. Once the categories were identified the second sub-question could be attempted.

The second question, “What is the range of themes that were investigated by the students under each category?” was answered by considering the titles and abstracts of all the theses and dissertations and then through reflection determining which of these studies represented a salient point in the research journey of the cohort. These works were then classified under the various categories and some logical pattern was determined. A problem that occurred here was that most of the theses or dissertations spanned a number of categories. For instance, the doctoral thesis of Willie Cilliers (1999) is entitled: An experiential learning process for the advancement of previously disadvantaged employees in an industrial context. This thesis touches on three topics, Learning by doing, Cultural Issues in Educational System development and Methodologies for Development of Educational Technology Systems. In this case the thesis is discussed under each topic. In other cases though, only the main thrust of the thesis was classified.

4. Discussion

4.1 How can the keywords extracted from 15 years of research be classified into distinct categories regarding educational technology and e-Learning?

The synthesis of the student keywords into nine topics is shown in Figure 2.
The eight themes, represented in Figure 2, show an initial attempt at the extraction of a research agenda in terms of the keywords supplied by the students. The main items on the agenda are, in reverse order:

- Cultural Issues (36)
- Web Based teaching and learning (37)
- Evaluation (39)
- Cooperative/Collaborative Learning (43)
- Development of e-Learning Systems (46)
- Interactive Learning Environments (67)
- Architectures of e-Learning systems (67)
- Pedagogical Issues and Teaching/Learning Strategies (190)

4.2 What is the range of themes that were investigated by the students under each category?

The following eight sections will be devoted to a qualitative discussion of the type of research done by students of the University over the past fifteen years, as it relates to the eight topics identified above.

4.2.1 Cultural Issues

Within the context of globalisation in education, spurred on by the growth of Internet-based education, and given the multi-cultural nature of South Africa and its position as a meeting point of well-resourced and under-resourced learners it is clear why cultural issues would play a very important role. A number of studies considered the role of the Internet in crossing either cultural or financial divides (De Swardt 2010, Mbambo 2002, Giladi, 2004, Cossa, 2002, Reynolds 2005). There were also a number of country-specific, or even province or region-specific studies (Steyn, 2004, Thomas 2006, Alexander 2005) as well as studies that considered the development of a unique Internet-based culture that is independent of the learner’s home culture (Meyer (salome) 2005, Du Plessis, 2006, Clarke, 1998)
4.2.2 Web Based teaching and learning

At least 14 keywords in this topic contain the word web in some way or another, while the word Internet appears 10 times and online eight times. Nevertheless not all the keywords with web in them were included here. Web Development, for instance, was classified under Methodologies for Development of Educational Technology Systems while WebCT went to Architectures for Educational Technology Systems. Other terms include distance education and distributed students. Perhaps the most interesting study in this category was that of Gabrielle De Villiers (De Villiers 2001) who investigated the use of the Internet for university students as well as school learners, both as a classroom resource or as a stand-alone classroom, in the field of hard sciences and the humanities. Her thesis ends with an impressive table in which she integrates what was learnt from all these different combinations. Another noteworthy project was a joint effort by three PhD students to investigate what happens when one plays learning games with a group of students over the Internet. Van Ryneveld (2005) investigated the role of the game metaphor, while Adendorff (2004) considered the activities of an online facilitator and Meyer (2005) wanted to understand why online learners would support one another, even in a competitive environment. Nagel (2008) followed up on this study a year or two later with an investigation into learner participation in an online environment.

At a subject-specific level Carr (2002) investigated the usefulness of the Internet as a resource for Mathematics teaching in a face-to-face foundation course, while Coetzee (Helene 2000) and Mbambo (2002) considered the use of the Internet for small, medium and micro industries in dairy farming and textile manufacture respectively. Van Eeden (2002) on the other hand, considered the use of Web-based training at a multinational corporation.

4.2.3 Evaluation

The keywords that were classified under evaluation included those of assessment of learner performance, as a subset of the evaluation of learning interventions or systems. Arguably the most comprehensive text in this category was an exploratory study by Fresen (2005) on Quality assurance practice in online (web-supported) learning in higher education. De Jager (2003) focused on “An integrated and holistic approach to assessment in outcome-based learning in South Africa”. An even more focused study was conducted by Marks (2008) who considered the effect of randomisation of multiple-choice items on the performance of test takers.

Two major evaluations took place of interactive learning environments, (Cronje 2008, Thomas (K) (2006) but these will be discussed under that heading.

4.2.4 Cooperative/Collaborative Learning

Given South Africa’s position as an emerging economy, and given the relatively high cost of technology it is not surprising that cooperative or collaborative learning was viewed as a way to increase the efficiency of use of a scarce resource. Nevertheless much of the research done on learning together focused on the social and pedagogical benefits of this mode of learning, rather than on the cost saving. In fact, there have been no studies that focused on economic considerations at all. Rahimi (2010) mentioned earlier, considered the value of peer tutoring. One of the earlier studies that focused primarily on cooperative, constructivist learning at school level was Seekola (1996), while Viljoen (2003) investigated a school where the regular timetable was suspended in favour of a “theme day” where they integrated computers, cooperative learning and constructivism across the curriculum by organising academic “theme days”.

The research, however, was not limited to classroom situations. The Web-based gaming project of Adendorff (2004), Meyer (2005) and Van Ryneveld (2005) as well as the work of Nagel (2008) are examples of learning communities at Masters’ level, while Mc Kay (2008) created a virtual community of practice consisting of high-school teachers who supported one another in the improvement of their teaching practice.
4.2.5 Development of e-Learning Systems

The key to the assignment of keywords to this category was the so-called “ADDIE” model of Educational Technology systems development. Addie stands for Analysis, Design, Development, Implementation and Evaluation. Since Evaluation is a free-standing topic in this article only the first four elements were considered. The keywords in this category range from the development of learning events using technology, online learning resources to full-on learning packages. On the other hand the keywords talk to the implementation of technological solutions into classrooms, schools, districts, corporations or even countries.

For her doctoral research Janse van Rensburg (1999), led a major research project that investigated the appropriateness of computer-integrated learning of mathematics for disadvantaged learners. Three Masters’ students contributed. Oosthuizen (1996) investigated the use of shareware and freeware drills and games. Moolman (1996) considered the use of spreadsheets, and Rootman (1996) developed a fully-fledged interactive adventure game in which learners had to solve mathematics problems before moving on to the next stage.


Then there were those who studied the implementation of an entire system into a classroom, district or even corporation. Morgan (2001) investigated the implementation of computers in a school. Pam Miller (1997) developed a taxonomy of implementation of computers into high schools, while Herbert Thomas (2006) did a retrospective evaluation of the implementation into schools in an education district ten years after the project had been terminated.


4.2.6 Interactive Learning Environments

This category can be distinguished from the previous one in that it is the actual functioning of the learning environment that is being studied rather than its development. Although there are quite a number of keywords represented here, there are relatively few research projects of which this topic was the main thrust. Research in this area was concerned mainly with determining what happens during the use of such an environment. Ackermann (2004) for instance, in the teaching of histology to medical students, investigated the feasibility of replacing a traditional microscope with PowerPoint slides. Cloete (2002) developed a training resource for the in-service training of library cataloguers.

The first study to investigate the nature of interactivity was by Clarke (1998). She did an analysis of the messages sent by students during a web-based course that was done using HTML coding and an automated mailing list, rather than a dedicated learning management system. Her research pre-dates the availability of WebCT. Pienaar (1998) developed a web portal for academics, and Bothma for information specialists.
The suitability of two learning platforms, *Blackboard* and *Moodle* was investigated by Thomas K (2006) and Cronje (2008) respectively.

### 4.2.7 Architectures of e-Learning Systems

Although this category accounts for the second-most number of keywords very few theses or dissertations had it as the main thrust. What follows instead is a breakdown of eight issues that were discussed across the various theses and dissertations, as they were distilled from the keywords. The first issue under discussion was the use or not of open source software and open courseware. In the context of a developing country the costs involved in the purchase of proprietary software has to be measured against the cost of in-house development. Secondly the researchers discussed the attributes of media – be it text, images, animation, video or audio. The third major theme concerned delivery mechanisms, which ranged from free-access Internet kiosks, computer laboratories, mobile devices such as laptops and tablets, all the way to mobile phones. Then there was discussion around the actual delivery channel, be it direct emails, mailing lists or “listservs”, chat rooms, bulletin boards, blogs, and static websites.

The fifth topic regarded timeframes – synchronous or asynchronous, and the appropriateness of each. Then followed a theme that we will call didactic orientation under which the term *blended learning* will resort. In essence what was discussed here was the nature of mediation, administration or facilitation of learning, and whether the aim was direct instruction or resource-based learning. Under direct instruction the most popular keyword was *elearning*. *Elearning* comprised course management systems, as well as tutorials, drills, simulations and games. The degree of fidelity, from text to virtual reality also played a role. Under resource-based learning came digital artefacts, digital libraries, information portals, online information services, inquiry tools, digital research environments, as well as information and knowledge management.

### 4.2.8 Pedagogical Issues and Teaching/Learning Strategies

Since the main thrust of the research was educational, rather than technological it is not surprising that the majority of keywords fell under this topic. Moreover, as was the case with the previous topic the keywords are generic and cut across various theses and dissertations. Three major divisions can be identified, *age groups*, *subject specific applications* and *general pedagogy*. The age groups could be classified from pre-school, primary school, high school, tertiary education and corporate training. Subject-specific applications included mathematics, physical science and chemistry, geography, languages (first, second and foreign) as well as a number of university-specific courses such as histology, anatomy, nursing, agriculture, and finally some workplace related issues such as computer skills, HIV and AIDS, marketing, information skills and teacher professional development.

By far the majority of the keywords in this section, however, concerned general issues of teaching and learning using technology. These were classified into eight sub-categories.

### 4.3 Learning and Instructional theory

The Masters’ course in Computer-integrated education that formed the foundation for most of the theses and dissertations that are analysed here was started in 1992. It then comes as no surprise that the rise of popularity of constructivism is quite evident. This is amplified by the fact that, in response to changing educational needs, the South African Government after 1994 embarked on a major programme of educational reform, that included the development of a new curriculum with strong emphasis on outcomes-based education and constructivist pedagogy. Nevertheless there were a number of studies that were still very much interested in the place of drill and practice within the context of outcomes-based education.
A very comprehensive study was undertaken by De Villiers (Ruth PhD) (2002) on *The dynamics of theory and practice in instructional systems design*, in which she developed a meta-model of six concepts or pedagogical dimensions to be considered in investigating pedagogical issues.

### 4.4 Behaviourism, Cognitive learning, Constructivism

Herselman (1999) considered the use of computer-based drill and practice games in second-language English teaching within the context of outcomes-based constructivist education.


An important development in this time was an investigation into the relationship between constructivism and behaviourism as complementary, rather than opposing theories. This research followed the publication of a position piece by the author (Kussumua 2007) which argued that constructivist and instructivist characteristics of a learning event should be plotted at right angles, thus producing four quadrants, (Instruction, integration, chaos and construction ). Two theses investigated the feasibility of such an idea, Burger (2006) and Kruger (2003).

### 4.5 Learning by doing

Authentic tasks, situated cognition and practice-based experiential learning have always been key drivers in the ethos of the masters’ and doctoral programme in Computer-Integrated Education at the University. The coursework preceding the half-dissertations, as well as the suggested readings and compulsory seminars for the research-based masters’ and doctoral programme have always modelled the process of learning by doing. It is therefore not surprising that students, in their research projects, would have explored the possibilities of computers in real or simulated situations. Many students entered the programme with a research project already in mind these were often related to business-performance, organizational learning or related problems that they experienced at work (Cilliers, 1999, Broos 2008, Fresen 2005, Steyn 2002). Added to this there has also been an interest in the autodidactic nature of computer skills. Research that may be highlighted include a number of investigations into the “Digital Doorway” (Herselman 1999) project of the Meraka Institute where computers were made available in disadvantaged communities and users were allowed to experiment with minimal invasion (Furstenburg 2005, Author & Burger 2006). A doctoral thesis also investigated the extent to which first-year students at a University in a disadvantaged community were able to make themselves computer literate through trial and error and spontaneous peer tutoring. (Rahimi 2010).

### 4.6 Effective and Conative factors

Rauscher (2005) made an analysis of email messages sent during an online course, and classified these according to various levels of Krathwohl’s taxonomy of the affective domain. Steyn (2002) investigated Csikszentmihalyi’s “Flow” theory and its effect on the motivation of knowledge workers. Wissing (1998) investigated the development of moral values through a tutorial programme for pre-schoolers.

As a part of her investigation into the introduction of computers into a middle-class suburban high school, Miller (1997) investigated the inhibiting role of computer anxiety.
The role of motivation, both intrinsic and extrinsic was covered in a large number of theses, as sub-sets of the main research problem more notably Labuschagne (2003) and Meyer (Salome Masters) (2000).

Meyer’s doctoral study was chiefly concerned with affective considerations and their contribution to the retention of online learners. Much has been written about why students drop out of online learning, but very little about why they stay. In a thesis entitled *The conative aspects of elearning* Helena Schoeman asked students to describe that moment when they gave up on their studies, but took it up again. Then she asked “Why”. In the process elements such as intelligence, volition, internal drive, self regulation, self-efficacy and support were identified.

### 4.7 Curriculum

Investigations into Curriculum dealt with the integration of computers into the curriculum (De Jager (PHD 2003), and Adendorff (Debbie Masters 2004); the development of curricula for online learning (Eduardo 2007) and with the curricula of computer studies and even the curricula of the subject of instructional design Stone (1995) De Villiers (Ruth PHD 2002), Reynolds, (Masters 2005), Nordhoff (2002).

Bartho Brittz(2004) investigated aspects to consider in developing a “real-life” curriculum for computer science, where high school learners were asked to develop software that would be useful to their schools, for instance in arranging an athletics meeting, or a morning market. Broos (2008) did a large-scale analysis of the Information, communication and technological competencies of middle managers in the Netherlands defence organisation.

A number of theses and dissertations touched on aspects of curriculum design as a subset of the incorporation of computers into subject areas. The subject areas included chemistry (De Jager Masters 1997), geography (Du Preez, 1995), language (Ferreira 1996), (Herselman 1999), statistics (Lamprecht 2002), mathematics, (Moolman 1996), (Moila 2007) and electricity (Fouche 1995, Steyn 1997).

### 4.8 Learning environments

Much was researched regarding where learning took place. The concept of environment ranged from online environments, home schooling, classroom ecology, computer laboratories, large classes, disadvantaged communities, and rural schools generally. Cronje (2008) combined two of the above when he investigated the suitability of *Moodle* as a platform for home schooling, and Thomas (K 2006) investigated the use of *Blackboard* in dealing with large classes. Miller (PhD 2003) investigated how knowledge was geographically dispersed in a high school classroom, Kruger (2003) did an interesting study in determining different uses for three computer laboratories at one primary school. He proposed a division into a laboratory for behaviourist drill and practice, one for general, integrated teaching, and one for constructivist exploration.

### 4.9 Educators

The term educator is the preferred word for South Africans who teach. Thus under this term we will include teachers, lecturers, instructors, facilitators, etc. Three doctoral studies of note here include Adendorff’s enquiry into the characteristics of an online facilitator, and De Jager’s assessment of the competencies of educators who participated in an Advanced Certificate in Computer-Integrated Education, while Addo (2003) investigated the quality of training given to teachers during the large-scale implementation of computers at selected schools. As has been reported previously Stone (1995), Mkansi (2004), McKay (2008) concentrated on the professional development of pre-service, or in-service training of educators.

Reynolds, (2010 PhD) on the other hand, considered the role that context played in the extent to which teachers embraced technology. Pienaar (1998) was interested in the information needs of academics.
4.10 Learners

As has been mentioned earlier South African education underwent a radical educational reform in the late 1990s. A key shift in educational focus was the shift towards learner-centred education. No wonder then that the key word Learner-centred appears at least six times. The studies also investigated how learners worked individually or in groups. But while many studies followed a learner-centred pedagogy there were a few studies that were focused specifically on learner characteristics.

A study that concentrated entirely on learner characteristics was that of Kafanabo (2006) who conducted an investigation into the interaction between multiple intelligences and the performance of learners’ in open-ended digital learning tasks. Miller (2003) investigated how learners acquire, recall, process and present information in a digitally enabled environment. Meyer (2005) and Schoeman (2006) asked why online learners stayed online.

4.11 Pedagogy – Teaching and Learning

In essence all the research reported in this article was about creating benefit for society by using technology to improve teaching and learning. As such each thesis or dissertation was about teaching and learning, so it would make more sense to concentrate in this section on the types of keywords that were selected, rather than on the theses and dissertations. The first group of keywords is effective teaching and learning, guidelines for teachers and guidelines for classroom use. These words refer to both teaching and learning. Then there are two other sets of keywords, those that refer mainly to teaching, and those that refer mainly to learning.

Under Teaching are, (in alphabetical order): Computer-integrated lesson, computer-integrated theme day, constructionist, information processing, knowledge creation, minimally invasive education, multi-dimensional methods, open-ended digital learning, pedagogically well-designed software, play, practicals, project based learning, projects, synthesis and tasks.

Under Learning are: Active learning, effective learning, learning (x5), learning behaviours and self-directed learning.

From the keywords one can see that a clear focus has emerged on teaching and learning with computers. Computers were seen as delivery vehicles of self-standing courses, as well as internet and email-based communication channels, and, of course, as information processors using various applications such as word processors, spreadsheets, databases, etc. In terms of teaching, both objectivist, constructivist and integrated teaching methods were investigated, with computers playing either a central or an ancillary role. In terms of learning it was the cognitive and affective domains that received special attention with learner characteristics and conative issues being on the forefront. The question is two-fold: “What makes people learn with computers, and what makes them keep on learning?”

4.11.1 Synthesis

The purpose of this research was to uncover an ex post facto “agenda” for research over fifteen years. In analysing the foregoing paragraphs it would seem that there are three the main trusts with Education taking a very firm lead, technology second, and community forming the background and context. The classification of the keywords are shown in Table 1.
Table 1: A classification of the research

5. Conclusions and recommendations

5.1 Methodological reflection

This study is primarily the result of the personal reflection of one person on a canon of 91 theses and dissertations presented at one university. As such it is influenced by the biases of the person doing the reflecting. The main threat in the study is to reliability, in that another person, with another mindset, may well come up with another classification. Nevertheless the appendices are presented for control purposes. The article is an exploration of the topics under investigation, rather than a statistical analysis of the theses themselves. The number of times a topic is addressed gives an indication of the popularity of the topic, rather than of its relative importance.
5.2 Reflection on the findings

These findings indicate that the theses and dissertations investigated in this article are strongly biased towards the themes of education and pedagogy, which is in keeping with the generally held view that teaching with technology, should be about teaching rather than about technology.

In conclusion the following trend emerges. Masters’ and doctoral students in this programme have tended first to investigate the educational application of new technologies as they emerged. Then they tried to improve their educational effectiveness, and sometimes tried to add value by the development of software or courseware. In a few instances the research has reached the level of evaluating existing implementations and their influence on society.

5.3 Recommendations for improved policy and practice

A weakness of this research lies in the vague nature of the keywords that were assigned by the authors to their research projects. In further research it may be wise to develop some standard set of descriptors that will work throughout the e-Learning community.

5.4 Recommendation for further research

The development and standardisation of a taxonomy of terms for e-Learning may be useful. Research leaders could then encourage their cohorts to stick to this taxonomy. In this way a very clear picture of the key issues and trends in the field would emerge to satisfy Simsek’s suggestion that “research and applications related to educational technology should go beyond the narrow framework of traditional educational paradigms” (2005, p. 190).

References


Using Digital Counterstories as Multimodal Pedagogy among South African Pre-service Student Educators to produce Stories of Resistance

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Abstract: While digital storytelling has entered higher education as a vehicle to reflect on issues of identity and difference, there is a paucity of research framed by a critical perspective unpacking underlying power structures in the classroom. This study reports on an ongoing project in a South African pre-service Teacher Education course in which final-year students reflected in the form of digital stories on the notion of difference and how it affected their journey to becoming a teacher. Drawing on theories of resistance, counterstorytelling and multimodality, five of these digital stories, students’ reflective essays and discussions in a focus group were analysed to investigate types of resistance in students’ narratives, their perceptions of the functions of counterstorytelling, and what multimodal analysis of these stories could tell us about the relationship of students’ identities, their choice of modes and their learning. Results of the study showed students’ intent to develop so-called ‘counterstories’, defined as stories that challenge social and racial injustice, which are usually not heard in education. Students also perceived telling of counterstories as useful to building communities among marginalised students, acting as model stories, providing an alternative window into the world of students of colour and a space for healing. While only one story could be defined as portraying ‘transformational resistance’, carrying the highest potential for social change, others were important documents of disadvantaged students’ fight for survival, and might well challenge some of the existing power structures in their classroom. Multimodal analysis of the stories revealed contradictory elements, highlighting the difficulty for students to resist dominant discourses, but also showing the increasing (conscious or unconscious) emotional audience manipulation evidenced in production of digital stories by the more privileged students. We suggest that engaging students in multimodal analysis of their own stories could facilitate a nuanced conversation on consciously and unconsciously held beliefs and assumptions, as well as an awareness of themselves that may lead to questioning the dominant discourse they have been socialised in.

Keywords: digital storytelling, counterstories, multimodal pedagogy, multimodal discourse analysis, social justice education, higher education, South Africa

1. Introduction

After nearly 20 years of independence, the effects of the deeply unjust and divisive history of Apartheid can still be felt in South African higher education (HE) classrooms. Since 1994 South African HE has undergone major transformations, driven by the twin imperatives of racial transformation and pressures for efficiency (Department of Education, 1997). However, the 2008 Ministerial Committee into Transformation and Social Cohesion in Higher Education drew a dire picture of the state of the South African HE context, confirming the pervasiveness of race and racism in people’s lives and a lack of student engagement across racial, social and cultural backgrounds (Soudien et al., 2008).
This situation makes it important to engage educators and learners in a conversation about difference and inherent power structures that are attached to specific students’ backgrounds. Young (2003: 349) claims that avoiding difficult topics in education is ‘a reflection of a societal denial that cultural factors matter and that such things as sexism, racism, and White privilege exist’. One way to overcome this resistance to engaging critically with students' historically situated and culturally mediated lived experiences is the telling of stories (Aveling, 2006). Digital storytelling, the process of developing a first-person narrative combining voice, sound and images into a short video (Lambert, 2010), has entered HE as one vehicle of facilitating students’ engagement across difference (Kobayashi, 2012; Walters et al., 2011; Sleeter and Tettegan, 2002).

However, there is a paucity of studies which explore digital storytelling from the perspective of critical pedagogy, concerned with issues of power and oppression in education (Ladson-Billings and Tate, 2006). This study, which is set in the School of Education and Social Sciences at a large South African University of Technology, aimed to address this gap and add to the small but growing body of knowledge on use of digital storytelling for facilitating the telling of critical stories, or counterstories - defined as stories that challenge social and racial injustice and which are usually not heard in the classroom (Delgado, 1989; Delgado-Bernal, 2001; Solorzano and Yosso, 2002).

Framed by theories of resistance, counterstorytelling and multimodality, this study is guided by the following research questions:

- What are the functions of these counterstories in the South African context?
- What types of counterstories/stories of resistance did students decide to tell?
- What can a multimodal analysis of students’ stories tell us about the complex relationship between the choice of modes, their identity and learning?

2. Literature review

2.1 Critical storytelling and counterstories

Storytelling in critical pedagogy aims to give voice to normally silenced people and subjugated knowledge, in order to provide ‘a way to communicate the experiences and realities of the oppressed, a first step on the road to justice’ (Ladson-Billings and Tate, 2006:21). Storytelling is valued as a means for expressing and documenting experiential knowledge (Delgado, 1989) about the particular experiences of those at the margins of society (Lynn, 2006).

Within critical storytelling are two types of stories: stock stories and counterstories. Stock stories, also called master narratives or majoritarian stories (Rolon-Dow, 2011), generate from a legacy of racial privilege, from stories in which racial privilege seems natural. They maintain this privilege and ‘carry layers of assumptions that person of positions of racialized privilege bring with them to discussions of racism, sexism, classism, and other forms of subordinations’ (Solorzano and Yosso, 2002: 28). Counterstories, on the other hand, ‘challenge social and racial injustice by listening to and learning from experiences of racism and resistance, despair and hope at the margins of society’ (Yosso, 2006: 171).

Counterstories are stories of resistance. Resistance theories emphasize students’ agency to ‘negotiate and struggle with structures and create meanings of their own from these conversations’ (Solorzano and Delgado Bernal, 2001: 315). Solorzano and Delgado Bernal (2001: 316) differentiate between four different types of student oppositional behaviour: (a) reactionary behaviour, (b) self-defeating resistance, (c) conformist resistance, and (d) transformational resistance. Figure 1 outlines the four types and their relation to social justice and social oppression. Transformation resistance is characterised by both a desire to critique oppression and motivation to fight for social justice, and as such shows the highest level of student agency.
Counterstories thus have distinct functions for the marginalised group telling these stories: they build community, challenge perceived wisdom, open up new windows into the reality of those living at the margins, and teach others that another reality can be constructed which is richer than the one we are living in (Solorzano and Yosso, 2002). Furthermore, Yosso (2006) and Delgado (1989) refer to the potential of healing through the communal hearing of counterstories. As stories of resistance, however, they also aim for social transformation (Solorzano and Delgado Bernal, 2001; Delgado, 1989) to shake dominant groups, the story listeners, out of their complacency, rattle their worldview and provide a means of ‘overcoming otherness, of forming a new collectivity based on the shared story’ (Delgado, 1989: 2438).

2.2 Multimodal pedagogy and critical digital storytelling

Vasudevan (2006: 208) maintains that not only are different stories needed, but also different ways of telling these stories: ‘the call for counterstories intersects with the possibilities of multimodal composing wherein new digital technologies can be used to create not only new kinds of texts but also new kinds of spaces for storytelling and story-listening’.

Multimodal texts consist of different kinds of multimodal meanings. A number of design elements feature in the multi-literacies theory, namely linguistic, visual, audio, gestural and spatial meaning. These design elements are essentially employment of multimodal discourse. How multimodal social semiotics get integrated and incorporated into formal as well as informal learning environments is seen as multimodal pedagogies: ‘Pedagogic processes can be understood as the selection and configuration of the semiotic resources available in the classroom’ (Stein & Newfield, 2006: 7).

Multimodal pedagogies are a way ‘to describe pedagogies which work across semiotic modes’ (Stein and Newfield, 2006: 9), and focus on ‘mode as a defining feature of communication in learning environments’ (ibid.). All communicative acts within a classroom can be viewed as multimodal, and students are seen as resourceful, creative and critical thinkers with the capacity to make individual meaning of multimodal messages. However, students interpret and deal with various modes differently, according to their differing cultural identities and histories. Most importantly, ‘in multimodal pedagogies, there is a conscious awareness of the relationship between modes, learning and identity’ (Stein and Newfield, 2006: 10). This means that students and educators make conscious and unconscious decisions about what modes might serve which situation better.
In this study the question is posed as to what extent students in this digital storytelling initiative acted consciously when relationships between modes, learning and identity were activated, as Kress and van Leeuwen (2001: 30) suggest:

Discursive practice in a multimodal environment consists of the ability to select the discourses which are to be ‘at play’ on a particular occasion, in a particular text ... But more than that, communicational practice consists of choosing the realisational modes which are apt for the specific purposes, audiences and occasions of text-making

Students as well as educators need to exercise adaptability and flexibility to oscillate between the most appropriate modes in all interactions. The authors see this particular action as one of the most important aspects of media production. Media consumption alone does not allow the development of critical media literacy in students. Kellner and Share (2005) highlight the importance of embedding critical media literacy into teaching and learning, both by analysing media culture as products of social production and struggle and teaching students to be critical of media representations and discourses. The also stress the importance of learning to use multimedia as modes of self-expression and social activism:

We strongly recommend a pedagogy of teaching critical media literacy through project-based media production...for making analyses more meaningful and empowering as students gain tools for responding and taking action on the social conditions and texts they are critiquing (Kellner and Share, 2007: 9).

Digital storytelling, a multimodal pedagogy, has gained increasing interest as a tool for engaging 21st century learners in HE. This study is heavily influenced by the digital storytelling model developed by the Center for Digital Storytelling (CDS) at the University of Berkeley. The digital storytelling model promoted by the CDS has as its main objective to fight for social justice by giving marginalised groups a voice.

The CDS sees digital storytelling not as an individual process, but foregrounds the importance of communal sharing of stories in a story circle (Lambert, 2010). Their model of creating digital stories is specific and involves a 3–4-day workshop in which participants develop their stories collaboratively. The communal sharing of stories is the main element in the process of digital storytelling, which they call story circle.

There are plenty of examples where digital storytelling has been used to explore issues of difference among students (Kobayashi, 2012; Sleeter and Tettegan, 2002; Walters et al., 2011); however, few studies are underpinned by a critical pedagogy perspective and even fewer focus specifically on the telling of counterstories.

Rolon-Dow’s (2011) account of using digital storytelling with coloured high school students in the United States of America is one example of its use for telling counterstories. She argues from a critical race theory (CRT) perspective and analyses digital stories in terms of stock stories and counter-narratives, with a particular focus on stereotypes and micro-aggressions. She concludes that ‘digital storytelling in combination with a CRT framework, can provide a window into understanding the ways race operates in the lives of youth and the micro-aggressions that students of colour face in today’s educational contexts’ (2006: 170). Another example is Vasudevan’s study on African American adolescent boys, who through the medium of a digital story authored counterstories: ‘new selves that challenged what they asserted as negative assumptions from other adults in their lives’ (2006: 209). However, there is a distinct gap in the literature on the use of critical digital storytelling in HE and in particular in the South African HE context.

3. Context of the study

This study is set in the context of South African pre-service teacher education in the School of Education and Social Sciences in a University of Technology. Students in this course are differently positioned in terms of gender, age, race and language and come from highly diverse economic, social and cultural backgrounds.
The particular site of this study is a course entitled ‘Professional Studies’ run in the second semester of the 2012 academic year. As the last assignment of this course final-year students developed reflective teaching portfolios in the form of a digital story. Students attended weekly workshops and were guided through the process of creating a digital story. The brief for the digital stories was to reflect on one critical incident they encountered in their teaching practice in which they experienced or witnessed difference, and how this impacted on their own teacher identity.

The final digital stories are short (3-5 minutes) digital movies, based on a written script of a maximum of 500 words, including digital images, which are either created by the student him-/herself or sourced from the Internet. A background sound provides ambience. For examples of digital stories produced in this project see http://www.youtube.com/user/cputstories. A final screening completes the digital storytelling process.

4. Methodology

Participants in this qualitative research study were drawn from the 62 students who produced digital stories as part of their Professional Studies course in the 2012 academic year. Of these 62 stories, five were purposively selected based on their narrative, which addressed issues of power and privilege. These five students were also invited to participate in a focus group discussion, which took place after the final screening. It is important to note that we see counterstories as not only focusing on racial privilege but also privilege that is based, for example, on gender or class (Solorzano and Yosso, 2002).

Data analysis of the written narratives, reflective essays and one focus group interview was done deductively (Maxwell 2008), whereby relevant data were mapped to the constructs found in the literature review, such as the functions of counterstorytelling. The digital stories were analysed by way of multimodal discourse analysis following Jewitt and Oyama’s (2001) social semiotic approach to analyse visual resources.

Theorists agree that multimodality describes the practice of using a collection of modes to communicate a message in contemporary society (Jewitt, 2010; Kress and van Leeuwen, 2001; Flewitt 2006). Baldry and Thibault (2006) define multimodal discourse analysis as the way in which different semiotic systems such as language, gesture, music and movement, are described and analysed in relation to each other in a certain instance. Jewitt defines multimodality as approaching ‘representation, communication and interaction as something more than language’ (2010: 1), while Baldry and Thibault (2006: 1) state that a multimodal perspective ‘may well encourage a critical rethinking and reformulation of the relationship between texts and society’.

This study was concerned with the narrative of conquering disadvantage, representational meaning and how the above narrative is expressed in a multimodal form, particularly though visuals and sound, interactive meaning by eliciting emotion and reaction from the viewer, and compositional elements, where meaning is also conveyed and added by placement within visuals, narrative and the timeline. The paper relates how these decisions impact on the ultimate meaning, derived from analysing the narrative, representational, interactive and compositional meaning as part of a multimodal analysis toolkit.

If one considers that multimodal social semiotics and multimodal pedagogies challenge the ‘logocentrism’ of traditional ‘human communication’ to include all forms of communication (Stein and Newfield, 2006: 9), it becomes evident that the form of communication should be continually considered. Human communication is not static; rather, it changes and moulds constantly within society and in terms of individual use. Both students and lecturers are creators of meaning. Keeping in mind who the audience may be, they choose their means and methods of communication from their store of available resources. At issue here is the historical shaping of these resources of communication within a social space, and how students within multimodal contexts deploy these.
The reasoning for the use of multimodal discourse analysis of research data lies within this holistically orientated analysis of meaning. Only by understanding the sum of the parts (instead of analysing components separately) can meaning be derived.

Ethical clearance was sought through the Research Committee of the School of Education and Social Sciences at the institution. Three of the five students allowed us to publish their stories as part of this study, and consequently we used their real names (Rafiq, Gina and Sibongile). The remaining two students’ names were changed for reasons of confidentiality (Vanessa and Lebogang).

5. Students’ narratives

Sibongile’s story (Struggle for a better life) is about the plight of a black South African woman (‘I am a female, a mother, a teacher, a wife’) who doesn’t want to accept the limiting expectations that others have for her. Growing up in a ‘remote village, where nobody knew anything about politics’, she wants more than to get married and have children. Although she has excellent matric results, her hopes of entering HE are quickly dashed when she realises that her status as a ‘black and poor’ woman prevents her from studying. In time she gets married and has children, but never gives up her dreams and aspirations, and eventually is accepted into the Teacher Education programme. Here she finds people that help her see herself in a different light, and she turns into an inspiration for her family and friends, modelling the possibility to better yourself: ‘not allowing anybody anymore to tell them what is possible and not possible for a black person in this country’.

Her story may be seen here: http://www.youtube.com/watch?v=hmDq8Rst_6w&feature=youtu.be

Lebogang’s story (Striving towards my success) talks about the challenges of black learners educated in rural communities, with limited funds and resources and the difficulties of multilingual education. She has a strong sense of what she deserves ‘a quality education’ and resents her parents for not being able to provide her with a better education, but one that had to rely on ‘live imagination and determination’. She decides to move to Cape Town to enter University, but finds courses full and her self-confidence waning. However, at the teacher training college she meets a representative of SASCO, one of the South African student unions, who helps her find a place at in the Teacher Education programme. She paints a different picture of SASCO, which is often criticised for being ‘trouble-makers’ and only interesting in striking or ‘toyi-toying’. Her experience with SASCO foregrounds its core business, namely facilitating underprivileged students’ access to HE.

Rafiq’s story (Against the Tide) is an account of a young coloured man’s rebellion against one of his tutor teachers during teaching practice. This teacher abuses his position of power as vice principal to neglect his teaching duties, letting the student teachers ‘babysit his learners while he was busy with other school and personal responsibilities’. Fuelled by his passion for his learners and his wish to return to them their ‘hunger for learning’, Rafiq decides to defy the teacher and reports him, being fully aware of the power structures in place and possible repercussions for himself and the learners.

His story may be seen here: http://www.youtube.com/watch?v=MO-cYpxGHuM&feature=c4-overview&list=UUm3GeRbRnpn-pkOTtaHSyOg

Vanessa’s story (Breaking free) is a young coloured woman’s account of coming to terms with sexual abuse. Fuelled by ‘anger, guilt, hate and shame’, for a long time her only way of dealing with her experience is silence. However, slowly she learns to open up and speak about what happened to her. She realises that by keeping silent she gives her molesters power and continues to let them control her life, which is a life of self-hatred and self-harm, hiding the true Vanessa ‘behind a façade’. Opening up and telling her family and close friends about what happened to her and how she feels about it allows her to regain a sense of worth and personal...
strength: ‘the more I spoke about it, the stronger I became’. Voicing her story to a larger crowd during the screening process is an act of liberation and healing.

Gina tells a story (Swept under the rug) about her raising awareness of the privilege of being white, and how to come to terms with this privilege in this new South Africa. Being confronted with learners from disadvantaged backgrounds and comparing their lives to her own, some of the unquestioned truths of her privileged upbringing with ‘white schools, white beaches, white friends’, so often ‘swept under the rug’, start to crumble, and feelings of pity and guilt wash over her. However, she recognised that these feelings, although in need of acknowledgement, will not take her further as she struggles to find ways of living with her white privilege among her mostly unprivileged learners without ‘being down-trodden, but aware of it, not in a guilt-ridden, defensive way, but rather in a positive, constructive way’.

Her story may be seen here:

http://www.youtube.com/watch?v=v7oVORl9GYQ&list=PLe5oHsfRWAnRFpFOgFccYrdiNb4V1KAB3]

6. Findings and discussion

The focus of this study was to explore the interplay of counterstorytelling and multimodal pedagogy in a pre-service Teacher Education course in the form of five digital stories. We discuss them below according to the three research questions guiding this study, namely: 1) the functions of counterstories as identified by students in a South African context; 2) the types of resistance in these narratives; and 3) what a multimodal analysis can reveal about students’ relationships between modes, learning and identity.

6.1 Purpose and function of counterstories

Students address various issues of power in their stories, challenging accounts that justify ‘the world as is’ (Delgado, 1989: 2421), telling stories of resistance against dominant discourses (Solorzano and Delgado Bernal, 2001). These stories are examples of ‘personal narratives’ (Solorzano and Yosso, 2002: 32), recounting individuals’ experiences with various forms of racism, classism and sexism, and how these forms of oppression intersect (Solorzano and Delgado Bernal, 2001). Four of the five stories are told by students of colour from formerly disadvantaged communities, namely Sibongile (black African female), Lebogang (black African female), Rafiq (coloured male) and Vanessa (coloured female). The fifth story is produced by a white female student, Gina, who comes from a formerly advantaged background.

Counterstories are by definition stories that are not usually told (Solorzano and Yosso, 2002), and facilitate the building of communities among marginalised students (ibid; Solorzano and Delgado Bernal, 2001). This emerges strongly in students’ comments. For example, Lebogang explains that for her the digital storytelling project provided a safe space for telling ‘untold’ stories that are usually not revealed due to ‘insecurities and fear of consequences’. Similarly, Vanessa emphasises that the digital storytelling project gives her a platform to ‘voice her story’, a story of sexual abuse, something that is usually not encouraged:

When I started voicing my story to people I think I was 19 or 18 when I finally spoke up and a lot of people – most of the people I spoke to, told me not to say anything … We have so many stories to tell and I think we all just needed a platform. Each one just needed a platform and in these four years we did so much talking in front of each other and so many orals and presentations, but what really mattered to us personally we didn’t have a platform to air it.

Another function of counterstorytelling is the building of communities among marginalised students (Solorzano and Yosso, 2002; Solorzano and Delgado Bernal, 2001), and in the students’ reflections we find evidence of this. Lebogang mentions students get to know each other in different ways and get to know what
really matters to particular students through this project. Vanessa describes the strengthening of her class community through the digital storytelling project:

Because of all the stress of the years we just lost each other. We lost ourselves and this just kind of brought us back together and reminded us who we were and what we meant to each other.

During the screening of the stories, these stories also act as model stories for other students – a window into a world that is different from what they expect, modelling possibilities for life other than the ones they usually hear about or experience (Solorzano and Delgado Bernal, 2001; Delgado, 1989), as Sibongile explains:

I think as a person you are not just in gender or your colour. You are much more ... and you are allowed to be outside the box. Your role is not only limited – from being a girl child to being a mother or a woman, a wife ... you can be much more than that and you can choose if you want to have children or don’t want to have children. It’s not something that should be expected of you and if you cannot fulfil it you are made to feel bad about it because even if you have children or you don’t have you still have – you are much more than what the society puts in a box ... you can be anything.

By sharing these counterstories students realise that they are not the only ones facing specific challenges, as Sibongile continues to explore:

Ja, because you think, ‘No man, you are the only person who is going through this’ ... other people are happy and they’re not facing the kind of problem that you are having. So when you talk together you see ‘Oh this is not only me. We are all like this’.

By telling counterstories there is potential for healing (Delgado, 1989; Solorzano, Ceja and Yosso, 2000). Students experience the sharing of these often painful stories and offering of their vulnerability to their peers as liberating and healing. Gina expands on how ‘Swept under the rug’ helped her come to terms with the feeling of guilt that comes with being white in South Africa: ‘I didn’t want to feel that guilt anymore but I wanted to express it, and now that I have actually expressed that guilt I don’t feel it so much anymore.’

In similar fashion Vanessa describes ‘Breaking free’: ‘I wanted my story to feel uncomfortable for me because I’m breaking free from my conformity and free from my silence.’

6.2 Types of resistance in counter-narratives
Solorzano and Delgado Bernal (2001) argue that there are multiple strategies of student resistance, some more overt than others. While in some of these narratives students decide to actively resist dominant discourses, other’s resistances might be more subtle and silent in an attempt ‘to prove others wrong’ (ibid: 319). For example, Rafiq sees himself as having strong morals and values, and this pushes him to publicly defy his tutor teacher. This teacher abuses his position of power as vice principal by neglecting his teaching duties. Rafiq decides to report him to the school authorities, as he explains:

Everyone at the specific school that I spoke to about this incident or about this specific person ... They always just said ‘Oh it’s a teacher who has been here for years and it’s not going to change’, and because coming back to role models and values ... I couldn’t just stand by and leave it ... I went against the tide. Something that I guess not all people will do because it’s inconvenient.

Sibongile, on the other hand, tells a story of her silent but stubborn rebellion against the view that as a black woman:

You are not just a human being ... you must be put in a certain box and you are expected to act in a certain way ... Even if it’s against your convictions or your personality but because you are a woman people are expecting certain things from you.
She tries to find a way to go against these expectations, and while meeting some of them (such as getting married and having children) she hangs on to her dream of empowering herself through university education, and when finally achieving this, proclaims proudly:

Today I am not just a teacher; I am an inspiration to others, to my family and friends, who all have gone back to institutions of learning, not allowing anybody anymore to tell them what is possible and not possible for a black person in this country.

Whether openly or silently, the students’ stories are a critique of social oppression. However, their focus on social justice is not equally strong. While Rafiq’s story is about his fight to better his students’ lives by openly attacking established power structures, Sibongile, Lebogang and Vanessa’s stories are what Yosso would call ‘resilience stories’, placed at the intersection between conformist and transformational resistance (Yosso and Delgado Bernal, 2001). These are stories about students’ own survival in dominant structures, about the strategies they employ which ‘leave the structures of domination intact, yet help the students survive and/or succeed’ (Yosso, 2000: 181).

This points to the multi-layeredness and complexity of privilege and oppression in the South African classroom: in this case it allows Rafiq an agency, as the only male in this group, to openly fight an oppressive system, an agency that is seemingly less accessible to his female colleagues. However, even if the other stories are not stories of open defiance, giving voice to these stories of survival and critical hope in a society where students from previously disadvantaged racial backgrounds continue to struggle to overcome internalised feelings of oppression and unworthiness may start to challenge and corrode some of the power structures in their classroom.

6.3 Relationship of multimodality, identity and learning

Multimodality implies that the combination of different modes will result in different meanings. As an example, the background sound of digital stories can alter the meaning of a digital story. This makes it important to analyse the various modes/modalities incorporated in a digital story, such as the narrative, narration, images and sound, but also transitions and animations, for their either complementary or contradictory meaning, and how their individual modalities make up the bigger picture (Kress & Van Leeuwen 2001).

Students reported that the multimodality helped them express their stories, as Lebogang explains: ‘… [using] images, sounds and music … made it easier for one to express him-/herself as it made the whole project to be fun and real’. Students are proud of the creativity and individuality that their digital stories afforded them, as Rafiq’s comment shows:

My friends and family know me for being slightly different. You will notice in the video, ranging from the music that I used in the video to colour. …The colour of the pictures or the type of pictures that I used. It’s all there for a reason.

What can a multimodal analysis tell us about students’ conscious and unconscious socioculturally embedded beliefs and assumptions that are usually hard to grasp? What can it tell us about the complex relationship of students’ choice of modes, their learning and their identity?

The following section provides a short analysis of the narrative, representational, interactive and compositional meanings that were used as part of a multimodal analysis toolkit to code and analyse particular elements in the stories.
6.3.1 Narrative

All five stories deal with difference and disadvantage. Lebogang and Sibongile’s stories centre on race and financial disadvantage and their personal journeys of overcoming poverty and disadvantage, while Vanessa’s story deals with sexual abuse of children. Rafiq also comments on the youth, and particularly teachers and their obligation to teach optimally. One can look at Lebogang, Sibongile and Rafiq’s stories as a continuum of the same narrative (racial privilege/disadvantage), while Vanessa’s touches a parallel narrative (sexual abuse). Gina’s story is part of the first group, but is borne out of an outsider’s perspective, where she discusses her own bind; how would she correct wrongs and make a difference in the current South African educational environment, while she obviously emerges from the advantaged point of view due to her own privileged racial background? This bind can be seen in her title: while the other four stories reflect a positive narrative progression in the title, Gina’s *Swept under a rug* retreats into a negative space by reflecting on hiding an existing narrative and the injustice that this entails.

6.3.2 Representational meaning

Two stories, Lebogang’s *Striving towards my success* and Sibongile’s *Struggle for a better life*, have the firmest of a concrete representational meaning. They follow a literal narrative with the unfolding of actions in a sequential pattern. The other three are classified more towards a conceptual narrative of an emotional journey, where actual events take a back seat to an emotional progression of events. For the last three the realisation of dreams is not about physical survival, but leans more towards attitudinal change and making a difference towards the emotional needs of their future students.

6.3.3 Interactive meaning

In this category one can make three distinctions. *Striving towards my success* and *Struggle for a better life* are notable in that the distance is generally kept further from the viewer. Images show this in that close-ups and intimate framings are minimal. The viewer is kept at a third person narrative distance, with offers images on a non-emotional level. Points of view are rarely used to convey emotion or additional action. Although the majority of images fall into the demand category, their level of engagement is lowered because of the distance kept from the viewer.

As in the semiotic speech analysis domain, one can distinguish between four different approaches of interaction, or what the originator of the image means, namely statements, questions, demands and offerings. A demand image would imply some reaction from the viewer; to take a stand about an issue, or so on. The subject in the image would typically talk straight into the camera or towards the viewer, eliciting a response. The next three stories, *Breaking Free*, *Against the Tide* and *Swept under the rug*, use distance and point of view effectively throughout the stories to convey emotion and to draw the viewer closer into engagement. Contact values, or how much weight a certain image implies, are effectively used on a demand level to elicit emotional engagement by the viewer. An established use of contact and distance can be detected in order to keep the viewer’s buy-in and to pace the story. Points of view are effectively used to convey very difficult portrayals of emotion. So would a bird’s eye view, for instance, convey a feeling of disconnect and distance, while an extreme low angle would elicit a feeling of inferiority and inadequacy.

6.3.4 Compositional meaning

It is within this last category that the five stories polarise into three further categories. *Striving towards my success* and *Struggle for a better life* show information values accurately and literally. Information values here refer to any way of conveying a certain emotion by way of image quality, placement, use of colour or angle and level of eye contact (for instance), that would influence or manipulate the value that a recipient would ascribe to that communication. They do not seem to manipulate the space to convey sophisticated layering of
emotion. No intention is found to manipulate saliency of elements within certain contexts, and modality generally leans towards reality.

*Breaking Free* and *Against the Tide* show a sophisticated use of framing to emphasise elements that can effectively convey complex emotion. In *Against the Tide*, for instance, the author particularly chose close-up images to elicit sympathy and emotion. There seems to be a definite rhythm in use, coinciding with the general rhythm of the spoken narrative. Framing is done mostly consciously in order to complement emotional concepts, while some elements are deliberately isolated to accentuate and complement the script. Modality is consistently manipulated in order to illustrate emotion.

*Swept under the rug*, however, leaps out in this last category of meaning. Apart from a significantly bigger variation of image, the information value within the corpus of images seems to be manipulated to a level where not only emotion is effectively conveyed, but it also includes irony, multiple narrative levels and a sophisticated connotational use of object in image. This more established use of image combined with sophisticated verbalisation of emotion and concept seems to be a double-edged sword. Because of its obvious sophistication, these images and skills in compilation could convey a sense of ingenious manipulation, and as such translate as a degree of dishonesty.

7. Conclusion

Drawing on theories of resistance, counterstorytelling and multimodality, this study set out to explore five pre-service teacher educators’ perceptions on types of resistance, functions of counterstorytelling and what a multimodal analysis could tell us about students’ relationship between modes, learning and identity. These five students told different stories of disadvantage and oppression, based on students’ race, gender, age, economic and hierarchical status. The particular set-up of this project in a highly diverse classroom allowed the hearing of stories that are usually not told, and proved a useful way of unearthing these resistance stories (Solorzano and Delgado Bernal, 2001). In telling these stories students constructed their own counter-realities (Delgado, 1989).

Findings show that students perceived the telling of counterstories as useful to building communities among marginalised students, acting as model stories, providing an alternative window into the world of students of colour and a space for healing, confirming that the functions of counterstorytelling as established in the American context are also valid in the South African context. Listening to these counterstories seemed beneficial for students identifying with both privilege and disadvantage, as other authors such as Opperman (2008) or Benmayor (2008) have found; they argue that not only marginalised students felt empowered and gained from the process of sharing and listening to ‘counterstories’, but privileged students equally benefitted and experienced transformation, allowing them to understand their own realities in more meaningful ways.

However, only one story could be classified as a ‘transformational resistance story’, with the greatest potential for social change (Solorzano and Delgado Bernal, 2001). This raises important questions about what we as educators could do to improve students’ agency to tell more stories that are ‘political, collective, conscious, and motivated by a sense that individual and social change is possible’ (Solorzano and Delgado Bernal, 2001: 320).

The multimodal element of this project appealed to students and allowed them to tell often painful stories in different modes, expressing their individuality and creativity in various ways. A multimodal analysis of the digital stories showed the extent to which individual modes allowed for a meaning-making that differed from and exceeded what would be possible through single or fewer modalities (Hull & James 2007).

However, it also revealed how students’ complex relationships of identity/privilege impacted selection of modes and learning. Their stories differ significantly in the degree of emotional manipulation of the audience
through conveying of their digital stories’ representational, interactive and compositional meaning. Sibongile and Lebogang’s (both black female students, and in the South African setting among the most disadvantaged student groups) developed the most straightforward stories, with a firm, concrete representational meaning following a literal narrative, keeping their distance and in general with low manipulation of audience response. The other three movies by coloured and white students (in relation to their peers more privileged in the South African classroom) show a more sophisticated approach in using, for example, distance and point of view to elicit an emotional response by the audience.

Gina’s story, ‘Swept under the rug’ (by the only white student among the five) stands out among these students’ stories. Her established use of image combined with sophisticated verbalisation of emotions and concepts may lead to what Joe Lambert from the CDS calls an ‘exaggerated tug on emotions’, which can be read as dishonesty (Lambert, 2013: 58). It also shows her bind as a privileged white student reflecting on her own privilege and finding a way to engage from this position of privilege with her mostly less privileged students. While Gina’s written story is a story of rebellion against white people’s silence around their racial privilege, her pictures tell a different story of racial stereotypes. This resonates with Rose Brushwood’s (2009) study, in which she analyses the tension between the written script and the images her participants selected for their stories, which were both ‘undermined and enriched by various ruptures, contradictions and gaps that emerge through the juxtaposition of sound and image’ (ibid: 212). She argues that it is specifically this juxtaposition which can show us our ‘unconscious and its ambivalences and resist the often tidy confines of our conscious telling’ (Milner, cited in Rose Brushwood, 2009: 212).

Engaging students in a multimodal analysis of their own stories could facilitate a nuanced conversation on consciously and unconsciously held beliefs and assumptions, which is otherwise difficult to achieve. This awareness of themselves may represent a first step for students to start questioning the dominant discourse they have been socialised in (Noel, 1995). Although the findings of this study are preliminary and this is research in progress, they indicate that bearing in mind the possibilities and challenges of multimodality, this type of multimodal pedagogy could suitably complement the telling of counterstories.

Particularly in this setting, in which students from highly diverse backgrounds created ‘new kinds of spaces for storytelling and story-listening’ (Vasudevan, 2006: 208), one question remains: What impact did this project have on the students listening to these stories? Delgado (1989: 2415) argues that social change can only happen when dominant groups join the marginalised in their fight for social justice. Have these stories managed to shake students identifying with privilege out of the complacency of dominant stories? Similar to other studies (e.g. Rolon-Dow, 2011), we acknowledge the need to explore the use of these to engage students and their community in a conversation around issues of oppression and privilege that can lead to social change, in order to place this pedagogical intervention firmly in the context of social justice education.

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Integrating eLearning to Support Medical Education at the New University of Botswana School of Medicine

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Abstract: Since the enrolment of its first cohort of students in 2009, the University of Botswana School of Medicine (UB SoM) has employed elearning as a key element to support and strengthen its model of decentralised medical education. Significant investments have been made in setting up the physical infrastructure, and in acquiring relevant expertise to develop and implement an elearning agenda in a context with practical challenges associated with medical education in decentralised setup. Following the enrolment of its first cohorts of medical students, and residents in Paediatrics and Internal Medicine between 2009 and 2010, the School also launched a Family Medicine training programme in 2011 at two rural sites. With the expectation of contributing to a positive teaching and learning environment for faculty, residents, and medical students in these remote areas, elearning is also seen as important for their retention, and thus for improved access to quality health care in rural Botswana. In this paper, the authors critically reflect on the strategies used to implement elearning at UB SoM over the past 18 months, and highlight challenges experienced while implementing elearning in a new medical school situated within an older university context. Strong relationships with partners were identified as a critical foundation for the long-term sustainability beyond the initial procurement and installation infrastructure. While confirming the obvious technical challenges in a setting like Botswana, the authors emphasise the need not to underestimate associated broader challenges in engaging a diverse range of users, partners and stakeholders; not to lose sight of the pedagogical goals that are meant to drive the choice and use of technology (rather than vice versa); and to ensure that the expected benefits of the technology can and will be shared and sustained by a range of partners in the long run.

Keywords: elearning, medical education, technology integration, mlearning, mhealth, tablets, ICT, sustainability

1. Introduction

1.1 Technology in higher education and medical education

The use of technology to enhance learning is not a new undertaking, and the potential benefits of technology integration (improved motivation, enhanced instructional methods, increased productivity, and information age skills) have been well documented (Roblyer and Doering, 2010). For example, Saettler (1990) notes that early references of technology integration in the United States date as far back as the early twentieth century. Over the decades, as information communication technologies (ICT) have emerged and come of age in the marketplace, many have sooner or later found their way into the classroom (e.g. radio, television, and personal computers). By the end of the twentieth century, educational institutions experienced an explosion of internet and networked computing combined with the use of personal hand held devices such as cellular phones, tablets and mini laptops (Reiser and Dempsey, 2007; Roblyer and Doering, 2010; Tiene and Ingram, 2001). Technology integration in medical education in developing countries including the University of Botswana School of Medicine (UB SoM) has followed a similar evolution to that of industrialised nations albeit behind the curve of these countries (Frehywot, et al. 2013; Sandars, 2012; Ruiz, Mintzer and Leipzig, 2006; Association of Medical Colleges, 2007).
Medical schools pursue elearning to address a range of educational challenges including faculty shortages in rural settings, attrition of healthcare professionals, and learning in non-classroom settings (Frehywot, et al. 2013). The two most transcendent uses of ICTs in medical education are to improve access to resources, and to foster collaboration and communication among peers and between learners and experts (Chang, et al. 2012; Sargeant 2005; Valke 2006). For instance, a Makerere University (Uganda) study indicated that students and practitioners valued access to the internet and thought such access had educational value (Chang et al. 2012). This is consistent with the use of technology to improve the educational experiences of learners and educators especially in rural areas (Chang et al. 2012). Valke (2006) and Lam et al. (2012) highlight the use of ICTs to acclimatize trainee physicians to workplace tools given ICTs increasing importance to healthcare delivery. The purpose of this paper is to highlight strategies engaged by the University of Botswana school of Medicine and the challenges experienced in implementing an elearning agenda to support medical education.

1.2 Rationale for Elearning at UB SoM

At its founding in 2009, UB SoM chose a problem-based learning (PBL) curriculum with elements of rural and community-based, socially accountable medicine to ensure that the curriculum would match with the health care needs and characteristics of medical practice in Botswana (Wood, 2003; Dolmans et al., 2005; Worley et al., 2006). In partnership with the Ministry of Health (MoH), UB SoM selected four clinical teaching sites: two rural sites in Maun (1000 km from main campus) and Mahalapye (200 km from main campus), which would also house the Master of Medicine (MMed) Family Medicine Programme; Sbrana Hospital (75 km from main campus), the nation’s only referral psychiatric hospital based in Lobatse; and Princess Marina Hospital (1 km from main campus), the nation’s largest tertiary referral hospital in Gaborone. The decision to provide rural exposure as a part of medical training was deemed important as a way to ground the training, research, and practice of the students and faculty in the varied health care needs of the community. Medical students’ early rural exposure and the establishment of Family Medicine training complexes in rural sites have been reported to improve retention of health workers in these areas. This is especially so if the learning and service environment is positive (Wilson et al., 2009; Curran and Rourke, 2004).

At UB SoM, elearning has always been recognized as a necessary element to facilitate effective and efficient teaching and learning including the context of clinical practice – both on and away from UB campus by addressing three primary issues inherent in in the nature of UB SoM’s curriculum. The learner driven PBL curriculum requires access to teaching, learning, and clinical resources in a timely and efficient manner regardless of location. Additionally, such a curriculum requires technologies that support and enhance active, engaged, and collaborative learning which are integral elements of the PBL learning process. Finally, the distributed nature of UB SoM clinical sites requires the use of ICT technologies that promote and enhance collaboration and communication in an attempt to reduce feelings of isolation and psychological distance amongst faculty and students across clinical sites. Collectively, the various technologies are employed to provide efficient and seamless access to learning resources, support communication and collaborative learning, as well as to enhance active and engaged learning.

2. Strategies for successful elearning implementation at UB SoM

Besides the distributed nature of UB SoM’s clinical teaching sites, implementing elearning at a new schools existing within an older university was bound to present both opportunities and challenges. Additionally, in light cost of technology (human and financial) and the ever-changing ICT landscape, As such, to mitigate the challenges and draw a wide range of resources UB SoM sought a systematic approach to implementing elearning by engaging several strategies to ensure successful implementation of the elearning agenda: a) grounding technology choices in learning theory, curriculum values, and teaching practice; b) thinking critically about infrastructure needs; c) engaging relevant partners to provide support and expertise; d) providing training and support for faculty and students; e) intentionally engaging faculty and students; f) considering
sustainability early and throughout the implementation process; and g) integrating continuous evaluation as part of the feedback process.

2.1 Grounding technology choices in curriculum values, learning theory and teaching practice

Sandars (2012) argues that “the focus of any educational intervention should be the learner” (p. 534). In line with that thinking, UB SoM sought to select technologies that would have clear pedagogical benefits to the PBL rural-based curriculum. As a result, UB SoM primarily implemented technologies that would either support and enhance the teaching and learning processes, or mitigate challenges inherent in its context. There was much intentionality in selecting technologies to align with and enhance pedagogical approaches inherent in UB SoM’s PBL based and rural curriculum. Video conferencing equipment was implemented to enhance communication and promote collaboration amongst learners, faculty and other practitioners, as a way to reduce the psychological distance between faculty and students at the various clinical sites. Equipped with databases of biomedical images, interactive boards were selected to support different learning styles and active collaboration during PBL sessions. The use of classroom response systems is expected to enhance active engagement in the plenary sessions by providing opportunities for embedded assessment and immediate feedback.

Tablets were implemented to ensure efficient and timely access to electronic teaching, learning, and clinical resources across site. The availability of a closed user group (on the SIM card) is expected encourage organic development of communities of practice where learners and specialist collaborate on healthcare delivery. The closed user group allows all device users to place unlimited calls to each other at no extra cost beyond the flat rate already paid by UB SoM.

2.2 Thinking critically about infrastructure needs

Beyond typical pedagogical considerations, there was need to think holistically about infrastructure, including thinking creatively about designing teaching and learning spaces where complementary coaching and mentoring can occur as an extension of bedside learning. This underscores the importance of local context considerations for successful implementation of the elearning programmes (Miner and Missen, 2005). Availability of adequate appropriate infrastructure is important for effective mobile and elearning strategies (Nartker et al., 2010; Frehywot et al., 2013).

Information technology (IT) infrastructure: Internet access at clinical sites is an essential backbone for the integration of video conferencing technologies, interactive boards, and tablets necessary to provide connectivity for communication, collaboration, and access to teaching, learning, and clinical resources. Over the past year, all four sites have had new connections to the internet or an expansion if limited access already existed. The expansion was to cover additional allocated spaces that originally did not have internet access. To date, all four clinical sites have wired and wireless high speed internet access. Three connect to main campus through a wide area network whose speed is dependent on the internet service provider (ISP). They converge to main campus and share bandwidth with the main campus. The fourth site (1000 km away from main campus), connects to the internet through a dedicated line.

Non-ICT infrastructure: The unique opportunity of working at existing clinical sites was that while government ownership of hospitals guarantees opportunities for continuous provision of clinical care, the hospitals were not designed as teaching hospitals and, as such, lacked the basic facilities and infrastructure conducive to other forms of teaching and learning beyond the bedside. At the tertiary hospital there is limited space has been availed at the library, the paediatric ward, and across a few places in the wards for lockers. Over the past year, each of the other three clinical sites has been outfitted with a small library, a teaching room, a storage room, resident/ undergraduate study room and lockers. The small library is fitted with networked computers that are connected to the internet, the University of Botswana Library’s (UB Library) databases, a limited collection of books, and quiet study areas. The teaching room is equipped with an interactive board and video conferencing equipment in addition to necessary furniture. Small closets are also available to secure
equipment (e.g. laptops, projectors, and cameras) that academic staff and learners can use for academic and professional work outside technology enabled spaces at clinical sites. The lockers are for students and residents to secure personal belongings while on ward rounds.

**Personnel infrastructure:** In addition to spaces and technology there needed to be strategic consideration about the skills, expertise and resources needed to implement the elearning agenda. UB SoM projects were analysed to determine the relevant skills and resource support needed to implement the elearning agenda. Based on these analyses, internal and external partners were sought to provide relevant support and expertise. The roles of the partners will be discussed in more detail in the partnership section. Additionally, SoM hired an instructional design specialist, and contracted a consultant on a temporary basis as an implementation specialist prior to the arrival of the instructional design specialist. The instructional design specialist was tasked with leading the technology integration process, supporting students and faculty in matters of teaching and learning with technology, ensuring that technology procurement continues to be grounded in curriculum values, learning theory, and teaching practice, as well as ensuring continuous engagement with internal and external partners. The consultant worked with the instructional designer for several months in order to accelerate the necessary procurement as well as develop relationships with key partners outside the university. The library has also recently hired a librarian for each of the clinical sites. Conversations are under way for each hospital to complement the UB Librarian with hospital personnel to ensure continuous coverage of the library.

2.3 Engaging relevant partners to provide support and expertise

From the beginning of the implementation process it became clear that a range of partners would need to be involved at all stages of the implementation process. The team developed strong working relationships with partners situated within the University of Botswana, experts and service providers (nationally and internationally), and hospitals hosting the medical training of UB SoM students and residents.

**Partners within the University of Botswana:** Being part of an older university has presented opportunities in that some of the partner department bring a wealth of experience and resources to support new initiatives. The IT department, UB Library, and Campus Services were some of the UB units that UB SoM actively engaged with this past year. The relationship with the IT and UB Library is expected to be a long term relationship, whereas the relationship with Campus Services is expected to be short-term and on an ‘as needed’ basis.

The IT team assumed a leadership responsibility in the selection and installation of our major ICT infrastructure. This included assessing teaching and learning spaces at various clinical sites, reviewing specifications, advising on appropriate solutions, and taking the lead on the tendering process. To date the IT department has overseen the successful installation of a) internet infrastructure at all four clinical sites; b) four video conferencing systems; and c) access control systems to secure equipment at two of the clinical sites.

The UB Library has been an essential partner in support of the mLearning Initiative (tablet project), in particular. In collaboration with Botswana University of Pennsylvania Partnership (BUP), UB Library led the process of identifying and testing research databases, and medical applications for the tablets. Both the senior librarian and the technical librarian have been instrumental in developing and facilitating the necessary training for tablet users as well as being actively engaged in the configuration of the tablets. To date, with active engagement of the UB Library, UB SoM has distributed 215 tablets to students, faculty and residents. At the time of tablet allocation, users received training on the general use of the device and the use of the medical and research resources.

The Campus Services department has been primarily responsible for assisting with furniture installations. They evaluated furniture from the old UB SoM building, and other used furniture stored across campus to determine which could be re-used at the clinical sites. They reconfigured and installed some of the old
furniture and as well as set up new furniture. To date, Campus Services has assisted with outfitting four library spaces, three teaching rooms, three undergraduate and graduate study spaces, and faculty offices at three of the four clinical sites.

Partners outside the University of Botswana: Experience elsewhere has demonstrated north-south and north-east partnerships can be invaluable especially when effectively grounded within the local context (Miner and Missen, 2005; Frehywot et al., 2013). In addition to UB partners, BUP has been a crucial partner in providing mobile health expertise, specifically in offering strategic and initial operational leadership for the mLearning Initiative. The relationship with BUP is a long-standing one in which BUP led collaborative research with UB SoM, UB Library and Orange Botswana that provided the basis for the upscale of the abovementioned tablet project. Based on the result of the pilot studies, UB SoM was able to identify the appropriate mobile device and data package for the mLearning Initiative (Goldbach et al., 2013). BUP continues to provide strategic leadership and partner engagement for the mLearning Initiative.

Through the partnership with BUP, UB SoM also acquired support partnerships with Orange Botswana and Mangoes Mobile. Orange Botswana is a telecom company providing UB SoM with a highly subsidised SIM card package. Mangoes Mobile, a mobile consulting company, led the configuration of the initial 170 tablets. They developed processes and documentation for subsequent configuration, and continue to provide troubleshooting and strategic support for the mLearning Initiative. They also developed a user analytics platform that creates reports on usage of applications on the tablet.

Another non-UB partner has been the team of superintendents at the four clinical sites who have become untiring champions for the UB SoM. In the midst of sometimes paralysing Ministry of Health and UB bureaucracies, they have found creative ways to provide invaluable space for UB SoM learners and faculty members at hospitals where space is a rare commodity. Besides making space available, another important aspect of support from the hospital superintendents has been their willingness to make provision for IT staff at their institutions to provide limited support to UB SoM where the university does not have IT personnel on the ground. At two of the hospitals where UB IT has no daily presence, Ministry of Health (MOH) IT personnel act as the first line of support for technology support. Overall, hospital superintendents have been active facilitators of UB SoM elearning strategy through the services they have provided and the opportunities they have made possible.

Working with partners has enabled SoM to go beyond what could have been achieved independently. Overall, partnerships have borne much fruit as evidenced by the number of functional projects in just eighteen months. It has become apparent that it is not enough to engage partners initially, but that the relationships need to be continually nurtured. One has to move beyond initial engagement to managing relationships with service units in ways that move the process forward. As such, there is need to navigate institutional dynamics and systems with wisdom and discernment by engaging service departments with patience and respect. Additionally, being educated about policies and procedures of supporting departments has proved necessary.

2.4 Intentionally engaging faculty and students

Beyond making technology available and acquiring the relevant support for projects, there is a need to provide training and support for faculty and learners to maximise the adoption and integration of technology effectively. Training ensures they have the requisite skills to take full advantage of the technology and minimise frustration (Nurjahan et al., 2002, Nartker et al., 2010; Frehywot et al., 2013). Moreover, faculty and students are important stakeholders to engage around developing a shared vision and receiving feedback since elearning integration is implemented for the benefit of their teaching and learning (Erah and Dairo, 2008; Maio and Ferreira, 2001).
The notion of intentionally engaging faculty and students meant involving them at the input as well as the training stages of the process once the technologies had been implemented.

**Providing training and support for faculty and students:** In the past year, limited training was provided on the use of tablets, video conferencing, and interactive boards. Currently UB SoM is articulating a plan to outline a strategy for faculty and learner support and development. For faculty, support will include both pedagogical and technological support and development. For students, support and development will include technological and pedagogical training to ensure that their learning is both effective and engaged. In particular, students need to acquire and/or improve self-directed metacognitive skills that will enable them to be successful in a learner-driven PBL curriculum and flourish as lifelong learners.

**Feedback from faculty and students:** The elearning team has provided opportunities for students and faculty to provide input both prior to and following implementation about how the use of technology would be most beneficial for their learning and teaching needs. For instance, residents at one of the clinical sites expressed preference for the use of video conferencing to support collaborative learning instead of tele-lecturing. They have also alerted the team to gaps in support and infrastructure availability which the team expects to correct in this fiscal year. For example, UBSOM’s undergraduate students provided feedback on the mLearning Initiative which prompted us to commit to allocating individual tablets to third-year students instead of loaning them tablets only when they were on rural rotations as we thought at the time. A team of six third-year students acted as ambassadors and assisted with the tablet setup. They also gave feedback on the process and ideas on distribution.

**2.5 Early and Continual Consideration of sustainability during Implementation**

Even as we implement UB SoM’s elearning agenda, sustainability has been a major consideration in light of the lifespan of the grant funding the agenda. First, engaging with university partners, especially the IT department, to ensure a shared vision and understanding has been crucial. Cresswell, Bates and Sheik (2013) argue that this process of consensus building is necessary to ensure commitment and co-ownership of projects. Ultimately, grant funded development (e.g. internet infrastructure) should be supported and maintained centrally by the IT department. Beyond the university departments taking responsibility for continued maintenance and support of technologies, there is a need for university departments to take responsibility for projects that were initially managed and supported by outside partners, i.e. capacity building. Finally, it has also been important to think creatively about funding technologies that need continuous replenishment, in particular our mLearning Initiative (Erah and Dairo, 2008).

UB SoM’s elearning agenda is primarily funded by a five year United States Government grant, the Medical Education Partnership Initiative. This funding has provided UB SoM with a unique opportunity to support medical education innovation without the financial constraints that most new schools, especially in resource limited settings, experience. Due to the limited life cycle of the MEPI grants, conversations and strategic planning at UB SoM and university support units (e.g. IT, Centre for Academic Development) is on-going to ensure that the investments made during the current grant become a stable part of the University processes beyond the grant’s lifecycle. The University IT has taken ownership of the procured technologies and taken responsibility for maintaining and supporting installed ICT infrastructure.

The UB SoM and UB Library are assuming many of the roles originally played by the technical assistants, BUP and Mangoes Mobile in the mLearning Initiative. The senior librarian for the Faculty of Health Sciences completed a 6 months internship at University of Pennsylvania Biomedical Library and consequently brought invaluable expertise on mobile medical resources to UB Library and UB SoM. An intern in the Distance Learning Unit and an Assistant Librarian have taken responsibility for the day-to-day operational aspect of the project.
In the near future, it is expected to assemble a team of undergraduate students, residents, and faculty members to function as an elearning advisory team. This team will work with the distance learning specialist on elearning planning, implementation, and support including issues of sustainability. Among other things, the team is expected to propose a viable model for funding tablet acquisition for the 2014-15 academic year.

2.6 Integrating continuous evaluation

Throughout the implementation process, user feedback has been received through informal focus groups, as well as meeting with the student body and the faculty. A study of the tablet project is under way and currently surveys and focus groups are being conducted. Data collection is expected to conclude by March 2014. A follow-up study that targets faculty is needed since the current study only focuses on medical students and residents. Faculty are encouraged to conduct research around the technologies they are using in order to gain a deeper understanding of the best strategies for using such technologies. Since UB SoM learning spaces at clinical sites are relatively new, a proposal is under way to explore learner satisfaction with infrastructure resources available to them at clinical sites.

3. Challenges faced during implementation

This section discusses three specific challenges that were experienced, thus far, during the implementation process so far: managing the process, managing user expectations, and managing partner expectation.

3.1 Managing the process

The procurement process has taken much longer than we expected. Although Business Services has been very supportive, both in working against tight deadlines and accommodating UB SoM needs in the midst of rigid university procedures, the process has at times been painfully slow, and time-consuming for all parties involved. Besides the slowness of the procurement process, challenges were also experienced in securing transportation in a timely manner to move equipment and furniture to clinical sites once delivered to main campus.

The tablet project ended up being much more time-consuming than was anticipated. Despite a robust team composed of two consultants, several staff members from UB and BUP, and volunteer students, the setup of the original 170 tablets lasted close to two months. Even with this experience and well documented processes, subsequent set-up is still time-consuming. The configuration process is generally complex and requires strong organisational skills.

3.2 Managing user expectations

While there are tangible developments targeted to improve the learning environment (e.g. lockers, desks, study spaces, and most significantly internet access), undergraduate students have tended to focus exclusively on the mLearning Initiative. Realising that there were not enough tablets to go around, they seemed to overlook all other developments and lobbied the mlearning implementation team tirelessly to ensure that they would receive tablets. To diffuse a potentially distracting and destructive situation, mlearning implementation team opted to engage the stakeholder (students) with honesty, openness and active listening. A meeting was requested with the undergraduate students and the team articulated the implementation process. Ultimately both parties were able to move forward together.

3.3 Managing partner expectation

In addition to delays with the setup of tablets, there were also some delays in securing SIM cards in a timely manner. The package created by Orange Botswana for the School of Medicine is unique and in some ways cutting-edge for Botswana’s context. In the end, the project required more testing from both parties than was
originally expected. In retrospect, it might have helped both parties to start the project with well-articulated benchmarks and clear time expectations on deliverables from both sides.

4. Conclusion and Future Plans

Technology continues to make inroads in medical education, despite the considerable technical challenges, financial and time costs around technology selection, procurement and installation. A multi-faceted systematic approach is crucial to the successful planning and implementation of an elearning agenda. Additionally, navigating challenges to achieve intended goals warrants being reflective, flexible, adaptable and intentional about nurturing strong strategic partnerships and relationships to ensure ownership and support for projects. Although the progress of University of Botswana School of Medicine’s elearning agenda is promising, the implementation process is still in the early stages. Therefore robust evaluation of efficacy, effectiveness and cost-effectiveness of the elearning agenda is important. It could be beneficial to explore how learners and faculty are utilising the various technologies and if technology is facilitating a positive learning environment as envisaged. Sustainability remains a concern despite deliberate steps to make it an inherent part of the implementation process. Moving forward, there are plans to develop a robust training plan to ensure that faculty and learners are engaging with technology beyond surface use. Ultimately, technology integration is not just about the tools one needs to use; it is a costly complex process that includes people, processes, securing and managing instructional and non-instructional resources, and analysis of learning and performance problems, among others (Reiser and Dempsey, 2007).

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Mobile Learning: A Kaleidoscope

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Abstract: CTI is an accredited private higher education institution (university) with the Higher Education Council (HEC) in South Africa. Its head office is in Fourways, Johannesburg. CTI has 12 campuses nationwide and offers higher certificates and degrees in commerce and information technology. These BCom and BSc degrees were rolled out to all 12 campuses from January 2013. All first year students received 10” Samsung tablets with their textbooks and course materials in digital format. We’ve worked closely with all role-players to ensure that all pillars for successful implementation of the e-book tablet project are in place. Timeous completion and conversion of course materials and e-textbooks for the start of the academic year in 2013 took extra time and focus of a dedicated project manager and multi-disciplinary team members. Several aspects were focused on during the conceptual, preparation and planning phases in 2012 (phase 1). This phase included aspects such as the student pilot project to establish the most suitable tablet to procure for students and lecturers, upgrading of infrastructure on campuses, lecturer training and the development of support materials, guidelines and rules for user standards. Phase 2 started in January 2013 with the implementation of a design-based research project which includes several planned interventions to ensure continuous development and support of lecturers and students with the focus on enhancing the academic experience of students. During this phase qualitative and quantitative methodologies were implemented and included the sharing of experiences using different digital media, tools and instruments to gather data from lecturers, students and other role-players. Data was analysed and compared with different theoretical frameworks for using integrating innovative technologies in learning environments. Changes that took place in teaching and learning practices will be discussed by way of using the technology integration matrix and other measurements to determine the development and movement of teaching and learning practices towards emerging pedagogies for the information age. More detail of research methodologies, actions and interventions as well as data gathering methods during project will be focused on and shared in this article.

Keywords: mobile learning, e-textbooks, tablet computers, faculty development, students’ enhancement of academic experience

1. Background: Discussion of research problem and motivation for study

Previously, CTI students received printed textbooks that were included in their fees. From 2013, new degree and higher certificate students are receiving tablet computers with e-books instead of printed text books. This per se is not a problem but research on the use of tablet computers for teaching and learning is needed for various reasons. Firstly: Literature regarding the use of tablet computers in higher education is limited to publications that report on using it as e book readers. In the second place does very little evidence exist of research that investigated a project of this extent specifically in higher education in South Africa. The third reason for more research is that most of the educational applications available for the use on tablet computers are focused on primary and secondary learners.

At CTI, a research project was started in January 2013, to identify the critical issues that will influence the optimum utilisation of tablets and e-books to improve the quality of teaching, learning and assessment. The focus of this paper is on one of three perspectives that were investigated in a research project at CTI, namely the lecturers’ perspective. The other two perspectives, which include that of the students and the infrastructure, will be briefly discussed and referred to where relevant.
1.1 Problem statement

Challenges for lecturers who used tablets during the first semester of 2013 at CTI include the following:

- Tablet computers, like other technologies, have the potential to become a distraction to students in class if it is not applied for structured activities.
- Additional to this, a high percentage of CTI’s lecturers have never used a tablet computer for teaching, learning and assessment and some lecturers have never used a tablet computer at all.

Issues experienced by CTI’s students include that

- Many of our students come from communities where not only infrastructure like wireless networks often does not exist but basic resources like electricity is also not a given.
- Technology has not been implemented in all schools and many students did not have exposure to the use of technology for teaching, learning and assessment.

These problems lead to our research question:

“What are the principles (critical issues) for the optimum utilisation of tablets and e-books to improve the quality of teaching, learning and assessment in a private higher education institution in South Africa?”

1.2 Aims and objectives of the study

The research problem discussed, as well as the research question that was stated above determines that aim of this research project should be to identify principles for the optimum utilisation of tablets and e-books to improve the quality of teaching, learning and assessment in a private higher education institution in South Africa.

To achieve this aim the following objectives were formulated, from three perspectives:

1.2.1 Lecturer perspective

- To provide iterative cycles of collaborative learning opportunities for lecturers in order to guide them through stages of acquisition, participation and contribution and eventually transformative (improved) practice (Stetsenko, 2008).
- To gather evidence that will demonstrate how lecturers integrate technology in the classroom regarding
  - Approaches/strategies that they apply
  - Methods that they employ
  - Specific technologies/applications that they use
- To subsequently identify principles of best practice of using tablets for teaching, learning and assessment, in other words to identify models of best practice, and record ‘lessons learnt’

1.2.2 Student perspective

- To investigate the impact of the use of tablets and e-books on teaching, learning and assessment
- To investigate the impact of the use of tablets on “changing the digital difference” and equipping students with additional skills
- To conduct a practical, usability study from the students’ perspective

1.2.3 Institutional (CTI) perspective

- To monitor and timeously identify problem areas
• To describe and adjust the infrastructure on campuses according to the needs of all users

This paper will concentrate on the first perspective, namely that of the lecturers.

2. Literature review and theoretical framework

Marc Prensky (2001) started a generational debate about the use of ICTs in education, early in the new millennium. He implied a generational division in this regard when he named young people who use digital technology with confidence because they grew up with it, “digital natives” and older, “more mature” users of technology, “digital immigrants”. Prensky alleged that the digital native generation have different expectations of life in general, and also specifically of learning.

Although this information is helpful it regretfully led to sweeping statements about digital natives such as “...they are forcing a change in the model of pedagogy...” (Tapscott, 2009). This is presently the cause of needlessly high levels of distress amongst many educators who often fear that learners might not respect them because of their lesser experience with technology. Some educators feel bewildered about the influence that technology might have on learning (Palfrey & Gasser quoted in Jones) and some even seem to be in a state of “moral panic” (Bennet, Maton, & Kervin, 2008). However, there is no clear-cut proof that young students intentionally form generational cohorts or express generation based demands pertaining to the use of technology for their studies (Jones & Binhui, 2011). Students who commence higher education, do not all possess the same level of technology proficiency (Nakamaru, 2011) and therefore do not belong to a single, homogeneous digital generation (Jones & Binhui, 2011). Furthermore, can the diversity of technology users not solely be ascribed to a difference in age; demographic factors play an equally important role (Jones & Binhui, 2011). This is especially relevant in the South-African context. Although a “digital difference” might exist between educators and learners it is fortunately not rigid and impossible to overcome (Jones & Binhui, 2011).

Almost a decade after he introduced the “digital native and immigrant” idea, Prensky introduced a new concept, namely that of “digital wisdom” (Prensky, 2009). He now proposed that everyone can become a “digitally enhanced individual” with digital wisdom obtainable through sufficient engagement with technology. This should reassure the older generation of educators but it also obliges them to attain digital wisdom for the sake of their learners, since technology has become an essential part of human development (Jones & Binhui, 2011). Related to Prensky’s ideas is Stoerger’s (2009) metaphor, the “Digital Melting Pot”. It describes the variety of technological aptitude and the co-existence of today’s technology users effectively. This also emphasises the opportunities for participation during which less competent technology users can become transformed through their own interaction with technology, as well as by the contributions of peers and other more experienced individuals (Stetsenko, 2008). Educators should be brave and humble enough to be lifelong learners and accept to learn not only with their learners(students) but also from them!

Educators should therefore make the most of technology as a meditational tool for teaching and learning and not simply dismiss it as a distraction. This will nonetheless only be possible if the integration of technology in the curriculum is well informed in order to promote meaningful learning. A more detailed and structured description for this melting pot of technology mediated doings is provided by Engeström’s (Engeström, 2009) notion of an activity system depicted in Figure 2. This idea of Engeström was derived from Vygotsky’s “Mediation triangle” and both these concepts are anchored in the Cultural Historical Activity Theory (CHAT), which is the theoretical framework of this study. According to Vygotsky, human action is object orientated and artefact (tool) mediated. His original notion of mediation is illustrated in Figure 1.
In spite of its simple structure, this diagram not only indicates the relationship between three central elements of human action: subject, instrument, and object (Engeström, Miettinen, & Punamäki, 1999), but also exemplifies the importance of tools in the mediation process as well as the fact that human action is always purposeful and directed at achieving a specific goal. Lautenbach (2005) described activity as human doings that work towards a common goal by employing *internal or external tools*, in order to reach a desired outcome. He (Lautenbach, 2011) also stated that educational technologies can provide and support interventions by extending the human mediating presence.

However, Vygotsky’s triangle does not explain this role that other humans play during activity. For this reason Engeström extended Vygotsky triangle to include another three elements; the community, its associated rules as well as the division of labour that is a result of diversity. Although this system is more complex, it is more applicable when focusing on the integration and use of technologies in the learning environment.

### 3. Research design and methodology

A mixed method (qualitative as well as quantitative) research approach was followed to gather data for the lecturer perspective i.e. to identify principles for the optimum implementation of tablet computers and e-books by lecturers, to improve their learning facilitation. A Design-based Research (DBR) design is most appropriate for the CTI educational context. This research design is seen as a “socially responsible” design for educational research (Reeves, Herrington, & Oliver, 2005) and we believe it to be in line with the vision of ICEL to bring together, as well as gain understanding of academic research *and* proven best practices. Another reason for our choice of methodology is that an activity system is normally used as unit of analysis during Design-based research (Engeström, 2009). The origin and concept of an extended activity system as part of CHAT was already explained during the literature review (Lautenbach, 2011).

#### 3.1 Design-based research

Various alternative terms are often used for this mostly qualitative research design; “design experiment”, “design research” and “development research”. The purpose of this research approach is to develop *solutions* to educational *challenges* in naturalistic learning situations and entails the implementation of practical interventions.

These interventions should never randomly be put into practice, but should always be anchored in theory, carefully planned and adhering to the following criteria:

Design-based Research is:

- Theory-driven; testing theoretical suppositions, which guide the design of interventions
• Interventionist; includes not only designed learning settings but also the systematic investigation of expected relationship between aspects of the intervention on learning
• Process-focused; trying to comprehend both the learning process and the influence of the designed interventions on that learning.
• Utility oriented; aiming to produce practical knowledge for educational improvement
• Collaborative; knowledge is constructed through participation and contribution of both the researcher and the participants
• Iterative; consisting of repeated cycles of planning, acting, observing and reflecting. Each cycle will consist of four distinctive, yet overlapping phases of planning, acting, observing and reflecting. Cycles will follow and build on each other as illustrated in Figure 4 (Adapted from (Rhodes, 2012) that follows.

![Figure 3: Successive learning interventions](image)

Our study, and the planned series of interventions (PSI) will be based on this model. Each intervention cycle will be planned by the researcher as a collaborative learning opportunity, providing suggestions of applications, methods and strategies to use on the tablet. Activities will be planned to include those that are active, collaborative, creative, integrative as well as evaluative, concentrating on developing a new pedagogy that is appropriate for the information age and not just adapt existing traditional pedagogies for the sake of using technology (See Table 1). Using this strategy to assist lecturers should encourage them to start transforming their learning facilitation (teaching) as well. During the “acting” phase lecturers will be requested to participate in the learning activities to acquire new knowledge and skills. Support will be available at all times. During the “observing” phase participants will be encouraged to contribute by providing suggestions of their own. The “reflection” phase will guide the planning of subsequent interventions. During this phase the researcher will identify preliminary principles for the optimal utilisation of tablets for teaching, learning and assessment. These principles will be the result of combined efforts by the researcher and the participants and can be included or adapted for subsequent phases.
Table 1: Classroom practice using emerging pedagogy for information age

<table>
<thead>
<tr>
<th>Aspect</th>
<th>Less of “Traditional Pedagogy”</th>
<th>More of “Emerging Pedagogy for information age”</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Activities prescribed by teachers</td>
<td>Activities determined through negotiation</td>
</tr>
<tr>
<td>Whole-class instruction</td>
<td>Small groups</td>
<td></td>
</tr>
<tr>
<td>Little variation activities</td>
<td>Varied activities</td>
<td></td>
</tr>
<tr>
<td>Pace determined by program</td>
<td>Pace determined by students</td>
<td></td>
</tr>
<tr>
<td>Collaboration</td>
<td>Individual</td>
<td>Working in teams</td>
</tr>
<tr>
<td></td>
<td>Homogeneous groups</td>
<td>Heterogeneous groups</td>
</tr>
<tr>
<td></td>
<td>Everyone for her/himself</td>
<td>Supporting each other</td>
</tr>
<tr>
<td>Creative</td>
<td>Reproductive learning</td>
<td>Productive learning</td>
</tr>
<tr>
<td></td>
<td>Apply known solutions to problems</td>
<td>Find new solutions for problems</td>
</tr>
<tr>
<td>Integrative</td>
<td>No link between theory and practice</td>
<td>Integrating theory and practice</td>
</tr>
<tr>
<td></td>
<td>Separate subjects</td>
<td>Relations between subjects</td>
</tr>
<tr>
<td></td>
<td>Discipline based</td>
<td>Theme based</td>
</tr>
<tr>
<td></td>
<td>Individual teaching</td>
<td>Teams of teachers or lecturers</td>
</tr>
<tr>
<td>Evaluative</td>
<td>Teacher or lecturer directed</td>
<td>Student directed</td>
</tr>
<tr>
<td></td>
<td>Summative</td>
<td>Formative</td>
</tr>
</tbody>
</table>

4. Actions and Timeframes

The following learning opportunities/interventions were planned (see tables)

For November 2012:
- A first learning intervention in the form of face-to-face tablet and e-book training workshops was planned, presented ("acted out") and observed on all 12 CTI campuses. Feedback was requested in the form of a survey.
- For the first semester of 2013:
  - An "online learning space" to build a community of practice
  - A "Research and Development Seminar" (RDS) on each campus to identify champions
  - One central “Research Indaba” (RI) where selected lecturers (champions) from all campuses will report and share their progress and learn from each other’s experiences.
- For the second semester of 2013:
The following interventions have already taken place:

4.1 Intervention 1:

Tablet and e-book orientation workshops were conducted in November and December 2012 on all 12 of CTI’s campuses. The lecturers received their tablets as well as hard copies of support manuals at these face-to-face and “hands-on” sessions. About 100 lecturers attended these workshops. After these workshops, in January 2013, a questionnaire was sent out to lecturers to evaluate their attitudes towards the use of tablets before and after the training as well as after the holidays. Thirty-seven lecturers completed and returned the questionnaire. The results obtained from this questionnaire indicated that the majority of the lecturers felt more positive after the training than before.

4.2 Intervention 2:

In February 2013, an online community was created on Google Groups to provide learning and collaboration opportunities for lecturers. Three learning tasks were posted.

- The purpose of the first learning task, namely to post a collage of themselves, was to encourage lecturers to introduce themselves on this platform, in order to nurture a culture of collaboration and develop this group as a community of practice (COP). Additional, this activity introduced those that have never used a platform such as Google Groups, to the basic functions of it.

- The second learning task on Google Groups firstly aimed to introduce the lecturers to the Technology Integration Matrix (TIM), depicted in Table 1, as a theoretical framework for their teaching with technology. It secondly served as an evaluation tool to choose appropriate technologies for teaching and learning with the help of the tablets. The lecturers were requested to evaluate “Socrative”, an assessment tool, as well as another application of their own choice with the TIM. Table 2 provides an example of how the TIM can be used to evaluate technologies as mediating tools.

- The third learning task continued on the foundation laid by the second, where the lecturers were requested to plan a specific lesson or a short series of lessons and indicate which platforms and applications they would use to utilise the tablets in a blended learning approach. They were asked to choose resources with the TIM in mind.
<table>
<thead>
<tr>
<th>Characteristics of Learning environment</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. Active: Students are actively engaged in using technology as a tool rather than passively receiving information from the technology.</td>
<td>Students mainly use technology for drill and practice and computer based training.</td>
<td>Students are beginning to utilize prescribed technology tools to create products, according to specific criteria, for example use a word processor to create a report.</td>
<td>Students are provided with opportunities to modify or personalise the use of prescribed technology tools to accomplish purposes, for example use colour or add graphics to MS office documents.</td>
<td>Students are empowered and encouraged throughout the day to select appropriate technology tools and actively apply them to the tasks at hand.</td>
<td>Students are provided with ongoing access to online resources, and encouraged to actively select and pursue topics beyond the limitations of the resource centre.</td>
</tr>
<tr>
<td>b. Collaborative: Students use technology tools to collaborate with others rather than working individually at all times.</td>
<td>Students primarily work alone when using technology.</td>
<td>Opportunities are provided for students to utilize prescribed collaborative tools, such as email, in conventional ways.</td>
<td>Students are allowed to select and modify technology tools to facilitate collaborative work.</td>
<td>Opportunities are created for students throughout the day and across subject areas, to utilize technology tools to facilitate collaborative learning.</td>
<td>Opportunities are created for students to use technology that enable them to collaborate with peers and experts irrespective of time zone or physical distances.</td>
</tr>
<tr>
<td>c. Constructive: Technology tools are used to build understanding rather than simply receive information.</td>
<td>Technology is only used to deliver information to students.</td>
<td>Students are encouraged to utilize prescribed constructive tools such as graphic organizers to build upon prior knowledge and construct meaning.</td>
<td>Opportunities are created and students are allowed to select and modify technology tools to assist them in the construction of understanding.</td>
<td>Students are allowed and opportunities are created for them to utilize technology to make connections and construct understanding across disciplines and throughout the day.</td>
<td>Students are allowed and opportunities are created for them to utilize technology to construct, share, and publish knowledge to a worldwide audience.</td>
</tr>
</tbody>
</table>
Table 3: Evaluation of applications with the Technology Integration Matrix

<table>
<thead>
<tr>
<th>Characteristics of Learning environment</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>➠ d. Authentic: Students use technology tools to solve real-world problems meaningful to them rather than working on artificial assignments.</td>
<td>Students are only expected to use technology to complete assigned activities that are generally unrelated to real-world problems.</td>
<td>Students are provided with opportunities to apply technology tools to some content-specific activities that are based on real-world problems.</td>
<td>Students are provided with opportunities to select and modify technology tools to solve problems based on real-world issues that are not necessarily content specific.</td>
<td>Students are allowed to select appropriate technology tools to complete authentic tasks across disciplines.</td>
<td>By means of technology tools, students are encouraged to participate in outside-of-school projects and problem-solving activities that have meaning for the students and the community.</td>
</tr>
<tr>
<td>➠ e. Goal Directed: Students use technology tools to set goals, plan activities, monitor progress, and evaluate results rather than simply completing assignments without reflection.</td>
<td>Students are provided with directions, guidance, and feedback from technology, rather than using technology tools to set goals, plan activities, monitor progress, or self-evaluate.</td>
<td>From time to time, students are provided with opportunities to use technology to either plan, monitor, or evaluate an activity.</td>
<td>Students are provided with opportunities to select and modify the use of technology tools to facilitate goal-setting, planning, monitoring, and evaluating specific activities.</td>
<td>Students are provided with opportunities to use technology tools to set goals, plan activities, monitor progress, and evaluate results throughout the curriculum.</td>
<td>Students are guided to engage in ongoing meta-cognitive activities at a level that would be unattainable without the support of technology tools.</td>
</tr>
</tbody>
</table>

4.3 Interventions 3 and 4:

In May and June of this year, Research and Development Seminars (RDSs) were conducted at each of CTI’s 12 campuses. In addition, a national Research Indaba (RI) was held in Johannesburg at the end of June. During these events, lecturers had the opportunity to report on their experiences with tablets and e-books during the
first semester of 2013. Lecturers were asked to convey what they did, what worked, what did not work as well as to make recommendations for the future implementation of technology in teaching, learning and assessment at CTI. Their presentations were observed and evaluated. 44 lecturers reported at the RDSs and 24 of these again at the RI. During a qualitative analysis of the data (observation of presentations and document analysis of 44 PowerPoint presentations), the most important issues (categories) were identified.

To triangulate this qualitative data and enhance the reliability and validity thereof, a questionnaire with 38 questions – based on the identified issues – was compiled and distributed to all lecturers who received tablets during the first semester of 2013. A total of 69 questionnaires were received back between 11 and 19 July 2013 and was subsequently analysed. This number of 69 represents 53% of the 130 lecturers who received tablets. The next section includes an analysis and graphical comparisons between the qualitative and quantitative data.

4.4 Intervention 5

During the second semester (July – October 2013), a second extended electronic learning intervention using another online space, namely “Edmodo” was initiated and monitored. The first objective was yet again to build and strengthen the community of practice between participating lecturers across time and distance that separate CTI’s 12 campuses. The second objective was to introduce the use of a learning management system. We hoped that newcomers would be inspired to participate after observing the feedback of the ‘more experienced’ lecturers that already participated during the interventions of the first semester.

Edmodo was chosen for several reasons. Lecturers can (and should) invite students to join the classrooms that they create. Edmodo can be used to communicate with their students, share information, post assignments and perform assessments. Other lecturers can also join as “observing teachers” and can therefore benefit not only by means of their own participation but also by observing that of other lecturers. Lecturers (“Teachers” on Edmodo) can join communities

The difference between the electronic learning intervention of the first semester and this was that students can be included and their participation observed

Again 3 learning tasks were given to the lecturers

A qualitative analysis of lecturers’ reflection diaries still need to be completed.

5. Findings and data analysis

5.1 Data collection methods and instruments

As previously discussed, Design-based Research requires a mixed method approach because qualitative as well as supporting quantitative data is needed. Therefore a variety of instruments were be utilised.

5.1.1 Questionnaires

Two different questionnaires were used, to obtain three different data sets, as discussed in the previous section:

- To obtain biographical data of students and lecturers.
- To obtain qualitative data of lecturers’ first experience (feelings/attitudes) with tablets as well as the training workshops
- To determine the progress and level of integration of technology according to the “Technology Integration Matrix”
5.1.2 Document analysis

Online resources like e-mails, participation on the electronic platform and PowerPoint presentations will be analysed.

5.1.3 Evaluation forms

Evaluation forms of lecturers’ presentations at the Research and Development seminars that will be hosted on all twelve campuses. These forms will be completed by peers (other lecturers), principals and academic coordinators.

5.2 Findings of intervention 1

These findings were obtained from the first questionnaire. This sample of participants consisted of lectures that responded by completing the questionnaire and represents 32% of the total of the lecturers that attended the training.

The first section of questions aimed to collect biographical information regarding the lecturers and include age, gender and subject area.

The age distribution of the sample of the participating lecturers is shown below in Figure 5.

![Figure 4: Age of sample of participating lecturers](image)

14 of this sample were female and 23 male

12 of the sample of participants are IT lecturers, 24 are Business lecturers and 1 person teaches in both fields of study.

The second section of questions was aimed at collecting data regarding the use of technology by the lecturers.

Only 4 of the 37 participants indicated that they have never used computers for teaching purposes before.

15 lecturers have used tablets before and 22 have not.

10 of the 15 lecturers who used tablets previously, used Samsung tablets.

The third and last section of the questionnaire included open ended questions, to determine the attitudes of the lecturers towards the use of tablet computers before and after the training workshops. The results are depicted below in Figure 5.
5.3 Findings of intervention 2

The lecturers who attended the campus RDSs and the RI were asked to answer the following four open-ended questions during their presentations:

- What did you do?
- What worked?
- What did not work?
- What do you recommend now?

In this section, qualitative as well as quantitative findings will be presented – mainly in the form of graphs – and then analysed, interpreted and discussed.

5.3.1 What did they do?

Lecturers had the opportunity to report on what they did during the first semester even before the RDS and RI. All lecturers who received tablets were invited to join the COP, which was created on “Google Groups” in February. They were requested to participate in four Learning Tasks during the course of the first semester. These were described in paragraph 1.3: Intervention 2. Lecturers were also encouraged to share information and ask advice from other group members. An analysis of the 84 posts on Google Groups showed that the lecturers used this platform as follows.

![Figure 5: Attitude changes of lecturers before and after training workshops - Percentage](image)
Figure 6: Lecturer activities on COP in first semester – “What did you do?”

This chart indicates that lecturers used the COP mainly to submit their Learning Tasks (50 of the 84 posts). However, during the RDSs, several lecturers reported that although they did not participate in the COP, they observed the activities of the group members, and benefitted from it (“lurked”). These lecturers also remarked that their non-participation was mainly due to a lack of time.

During the RDSs, all lecturers reported back on how they accessed and used the e-books (CTI course books and Pearson eText) as well as other applications. These applications are:

- Cite me
- Droid edit
- Dropbox
- E planner
- Ebscohost
- Edmodo
- End note
- English dictionary offline
- Evernote
- Facebook
- Freebookcentre.net
- G talk
- WhatsApp
- Google drive
- HR exec magazine
- HR management
- HR tools
- Khan academy
- Kingsoft Office
- Linkedin
- Mind tools
- Online personality tests
- Socrative

What worked?

The lecturer presentations from the RDSs and RI yielded valuable qualitative data. After having analysed this data, various themes were identified. These themes can be arranged into the following four categories:

- On-campus infrastructure
- Device-specific issues/requirements/preferences
- Software-specific issues/requirements/preferences
• Implications for teaching and learning.

The identified problems were addressed in the questionnaire to determine the opinions of a bigger sample of lecturers.

At this point, it is necessary to stress that the charts representing the qualitative data (derived from the lecturer presentations) should at all times be read and interpreted in conjunction with the related charts representing the quantitative data obtained from the questionnaire.

6. Qualitative data obtained from the analysis of lecturer presentations

The following graph represents the variety of themes mentioned by lecturers during presentations at the RDSs and RI.

Figure 7: Qualitative data - "What worked?"

The aspect that lecturers reported most favourably on (59% of lecturers mentioned it) was the convenience and ease of sharing information with their students on the campus network. Related to this was lecturer satisfaction with the CTI course books that were also available on the campus network. Another very prominent, positive aspect was that the majority of lecturers agreed that the use of tablets and e-books enhances teaching and learning. A substantial proportion of the lecturers (27%) were of the opinion that tablets encourage the active engagement of students, and an even larger proportion (48%) were more specific and mentioned that the tablets enable students to do online research in class. For this reason, a set of questions addressing the remaining four aspects of the TIM was included in the questionnaire.

7. Quantitative data obtained from the lecturer questionnaire

Questions relating to the TIM (refer to paragraph 1.3, Intervention 2) were included in the questionnaire because the TIM was used as a theoretical framework for the learning tasks completed by the lecturers during
the first semester. The TIM was also used as a tool for reflection with which lecturers could evaluate the
different elements of their own teaching and learning practices. The majority of the lecturers agreed or fully
agreed that the use of tablets promotes transformative teaching and learning practices because it fosters
active engagement, collaboration as well as constructive, authentic and goal-directed learning.

**Technology Integration Matrix: Tablets and e-books promote ...........**

<table>
<thead>
<tr>
<th></th>
<th>Active Engagement</th>
<th>Collaboration</th>
<th>Constructive Learning</th>
<th>Authentic Learning</th>
<th>Goal Directed Learning</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strongly Disagree</td>
<td>9%</td>
<td>7%</td>
<td>9%</td>
<td>10%</td>
<td>7%</td>
</tr>
<tr>
<td>Disagree</td>
<td>14%</td>
<td>12%</td>
<td>13%</td>
<td>17%</td>
<td>16%</td>
</tr>
<tr>
<td>Agree</td>
<td>32%</td>
<td>32%</td>
<td>30%</td>
<td>29%</td>
<td>36%</td>
</tr>
<tr>
<td>Fully Agree</td>
<td>45%</td>
<td>49%</td>
<td>48%</td>
<td>43%</td>
<td>41%</td>
</tr>
</tbody>
</table>

**Figure 8:** Benefits of tablets and e-books for teaching and learning according to TIM

There were a number of other related topics that emerged from the presentations that indicated that lecturers
believe that the use of tablets augments teaching and learning. These topics were specifically addressed in the
questionnaire and yielded the following results:
The most important insight from this section ("What worked?") is therefore that lecturers feel that the use of tablets can help improve the quality of teaching and learning as well as promote transformative teaching practices.

7.1.1 What did not work?

8. Qualitative data obtained from the analysis of lecturer presentations

Note: Please remember to interpret the qualitative data in conjunction with the related quantitative data.

The analysis of the lecturer presentations provided valuable qualitative data regarding the nature of problems experienced on the various campuses. These problems were divided into the following four categories:

- On-campus infrastructure
- Device-specific issues
- Software-specific issues
- Implications for teaching and learning.

The information gleaned from the lecturer presentations was used to compile the questionnaire where the above categories of problems were addressed by means of more specific questions. The opinions of a bigger sample of lecturers could therefore be obtained in the form of quantitative data.

Figure 9: Other benefits of tablets and e-books for teaching and learning
Marlena Kruger and Riana Bester

Figure 5 represents the problems mentioned by lecturers during their presentations at the RDSs and the RI.

Figure 10: Qualitative data: "What did not work?"

The insufficient Wi-Fi coverage on the campuses was by far the most prevalent cause of frustration for lecturers (64% mentioned this). Following on this were the problems encountered with the Pearson eText application (32%) and the students’ inability to use technology (23%).

9. Quantitative data obtained from the lecturer questionnaire

The majority of lecturers, namely 48 of the 69 (69%), described the Wi-Fi coverage as insufficient or unsatisfactory.

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The remaining 29% of lecturers that indicated otherwise might be lecturers who were lucky enough to have good Wi-Fi coverage in their classes and offices. During the RDSs, lecturers reported that Wi-Fi coverage was either generally bad or only good in certain areas on a campus. A few lecturers remarked during the presentations how students soon identified the “good” areas and gathered there, often on staircases and in the passages.

Forty of the 69 lecturers (58%) who completed the questionnaire had used Pearson eText books and therefore the Pearson eText application (see Figure 7). Thirty of these 40 lecturers, therefore 75%, who used Pearson eText books indicated that they experienced problems with the eText application (see Figure 8).

A comparison of the problems experienced with the applications revealed the following results (see figure 8): most of the problems experienced by lecturers, excluding those experienced with Pearson eText, were with CTI course books and the distribution of material via the campus networks. This seemed to be directly related to the Wi-Fi coverage and campus infrastructure. One other application that caused frustration was “Polaris Office”, one of the standard applications on the Samsung Galaxy tablet. A substantial number of lecturers suggested that the “Kingsoft Office” application be used instead. It will therefore be tested in the second semester and recommendations will be made accordingly. It is possible that the problems experienced with ES File Explorer occurred when lecturers tried to up- or download material to or from the campus networks. Ten per cent of lecturers experienced problems with Adobe Reader, a situation that can be resolved by using this software more often.
Problems experienced with applications used on the tablet

Figure 13: Problems experienced with applications used on the tablet

The concerns of lecturers who participated in the RDSs and the RI regarding students’ lack of digital literacy were reiterated in their answers to a specific question in the questionnaire addressing this problem (see Figure 9).

Figure 14: Students' lack of digital literacy makes the use of tablets impossible

Forty-one of the 69 lecturers agreed or fully agreed that this makes the use of tablets for teaching and learning impossible. This amounts to 60% of the lecturers who completed the questionnaire. A change in the format
and frequency of the training for students might alleviate the problem and alter this opinion. Student training and support, as well as the planned involvement of resource centre staff in this regard, will be discussed in the following section.

9.1.1 Recommendations made by lecturers

10. Qualitative data obtained from observations and document analysis of lecturer presentations

Note: Please remember to interpret the qualitative data in conjunction with the related quantitative data.

Figure 10 denotes the various themes of recommendations made by lecturers during their presentations at the RDSs and the Ri. The recommendation most often made by lecturers was that to upgrade the campuses’ Wi-Fi networks came out the strongest. The second group of most common suggestions recommendation related to student training. The third recommendation was that a Learning Management System (LMS) be implemented to support blended learning was the third important need that was identified. The fourth aspect that needs consideration, implied by several requests that were made, was for either a different device or added functionalities to the device that is currently being used. These four recommendations obtained by the qualitative data analysis were further investigated and confirmed by means of specific questions in the questionnaire (see figures 11-14).

Figure 15: Qualitative data: Recommendations made by lecturers

![Figure 15: Qualitative data: Recommendations made by lecturers](image-url)
11. Quantitative data obtained from the lecturer questionnaire

Answers to the questions pertaining to the format of future training for lecturers as well as students (see Figure 11) indicated not only that lecturers feel the face-to-face element should not be completely removed but also that an electronic component should be added to provide a blended learning approach and on-going accessibility to training material and learning opportunities.

![Training should be .......

Lecturer training

- face to face only: 28%
- electronically e.g. video clips only: 6%
- a blend of the two methods: 67%

Student training

- face to face only: 35%
- electronically e.g. video clips only: 1%
- a blend of the two methods: 64%

Figure 16: Requested format of training

The need to change the format and frequency of training for students exists because students are allowed to register late in the semester and they receive their tablets only once payment for their studies has been finalised. As a result, many students attended the training without devices and could not use it when they received it as late as March in certain cases. Students admitted in the mid-year intake in July might have similar experiences. The inclusion of electronic elements like video clips would enable these students to master some of the skills more independently and will lessen the burden on lecturers and Academic Coordinators (ACs). As part of the blended learning approach, it has been decided to involve the resource centre staff (librarians as well as assistants) in the technology support for students. Capacity building and equipping them with tablets has already begun and will be explored and implemented in the second semester.

The responses to the question regarding the need for an LMS indicate that 87% of the lecturers are of the opinion that it is necessary.

![Need LMS

- definitely not: 0%
- not necessary: 4%
- possibly: 9%
- definitely: 87%

Figure 17: The need for an LMS

The implementation of an LMS or another support platform is therefore undeniably urgent.
Forty-seven of the 69 lecturers (68%) who completed the questionnaire suggested that an alternative device should replace the tablets currently in use.

![Different device?](image1)

Figure 18: The need for a different device

Functionalities that are deemed necessary include the following:

![Device needs](image2)

Figure 19: Functionalities requested for device

The need for a device with 3G connectivity is the most urgent and was requested by 83% of the lecturers who completed the questionnaire. This problem is purely hardware related and fairly easy to solve. The next two needs, namely those for a device with a keyboard and multiple window display capability, are possible to overcome by using the device more often and improving the skills needed. The need for a device with more storage capacity can be overcome by replacing the current device by one that has a USB port.

12. Recommendations and proposed actions

As mentioned earlier in this report, four categories of problems experienced by lecturers regarding the use of tablets and e-books for teaching and learning were identified. These categories are as follows: In the first place, infrastructure, secondly and thirdly device and software specific requirements and preferences and
finally implications for teaching and learning. The following actions have either already been taken or are currently being investigated.

12.1 Upgrade campus networks and Wi-Fi coverage
This specific aspect was repeatedly addressed through lecturers’ reactions and answers to all three questions asked at the RDSs and the RI:

- **What worked?**
  The distribution of material through the campus network and the active engagement of students by the use of Internet in class worked well. The success of both of these activities is dependent on the reliability of the infrastructure on campuses.

- **What did not work?**
  The Wi-Fi coverage on campuses is insufficient.

- **Recommendations made by lecturers**
  The recommendation most made was to upgrade the Wi-Fi coverage and campus infrastructure.

It can be reported that the upgrade to increase the number of access points and accommodate more concurrent users has already been completed. Details are available from Russell Lang at CTI GHO (russellhl@cti.co.za).

12.2 Pearson eText: Books and applications (software problems)
This academic semester (second semester: July–November 2013), CTI is only using two Pearson eText books and they are available in e-pdf format on the campus network. We need to consider this a more permanent solution until another workable application can be found. Alternative applications are currently being tested by Pearson.

12.3 Alternative device or added functionalities
This request cannot really be ignored and is currently being investigated. One device that seems to be a good replacement is the “Netbook”. This device has 3G connectivity, USB ports as well as a keyboard and is smaller than a laptop, which makes it more mobile. However, it cannot be concluded if this need for a different device is a case of preference by lecturers only. The results of the student survey will either confirm or negate this.

12.4 Change in the format and frequency of student training
As discussed in the previous section, this issue is related to late admissions of students and the due date for payment. We have already found some suitable YouTube videos that can be uploaded to the campus networks. The inclusion of this electronic element as part of the training should alleviate some of the concerns about students’ lack of digital literacy. Another action that should improve the support for students is the involvement of resource centre staff. Campuses were requested to make at least one device available to the staff in the resource centre. This will enable them to provide more personal support to students that need help with the use of tablets and e-books.
12.5 LMS implementation

An LMS or similar electronic platform is necessary to support on-going blended learning and training. However, it will place more pressure on campuses’ infrastructure. For this reason we are delaying a full scale implementation and are investigating some options. Edmodo, an open source application, is currently used by 23 lecturers on many campuses. The request to explore this application is part of the learning tasks for the lecturers participating in the COP in the second semester. “My labs +”, a Pearson product, is another alternative that we will start investigating in August. E-portal, a Moodle-based LMS, currently used by Midrand Graduate Institute (MGI) will also be reviewed.

13. Conclusion – from a lecturer perspective

The overall aim of the implementation of tablets and e-books is to improve the quality of education, i.e. improve and transform current, outdated teaching and learning practices. The focus of this part of the research project focused on the professional development of lecturers and the implementation of core characteristics of an engaged and enabling learning environment, such as interaction and collaboration, together with constructive, authentic and goal-directed learning (TIM) in order to achieve better retention, pass and graduation throughput rates of our students and to prepare them for the workplace (increase employability of all CTI students).

The continuous professional development of lecturers to become lifelong learners is essential - more specifically with regards to developing their 21st Century teaching skills (including their digital literacy skills such as the use of social media and educational technologies) and providing them with ongoing support in a technology-enhanced learning environment are some of the critical pillars to ensure successful implementation of new technologies such as e-books and tablets in the learning environment.

There were five important factors identified during the first semester, of which the most important two were that of insufficient IT infrastructure and associated bandwidth and connectivity. Based on some interviews and critical feedback already received during the first part of the first semester from lecturers and students (before the finalisation of this research report), we already had to implement “interim” solutions to ensure better user experiences on campuses from the start of the second semester (although unfortunately not all campuses could be upgraded before the start of second semester).

Sufficient IT infrastructure, together with the smooth downloading of Pearson eText books to be available offline and off campus, as critical factors for the overall successful implementation of this project and the further roll-out of tablets and e-books to all first year students on all CTI and MGI campuses at the beginning of 2014, must be highlighted and be given the highest priority. The remaining three factors that were identified from the lecturers’ perspective of the research project that have an influence on the optimal implementation of tablets and e-books namely the choice of device and software, as well as the perceived influence of tablets on teaching and learning, the format of lecturer and student training and support as well as the implementation of an LMS have already been communicated to the relevant people and where possible being addressed and further explored. The further roll-out of this project in the second semester, based on the flexible approach in the form of Design-based research will continue and is essential for further and ongoing developments and overall improvement of efficacy.

References


**JiFUNzeni: A Blended Learning Approach for Sustainable Teachers’ Professional Development**

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**Abstract:** JiFUNzeni blended learning approach is a sustainable approach to provision of professional development (PD) for those in challenging educational contexts. JiFUNzeni approach emphasizes training regional experts to create blended learning content, working with appropriate technology while building content repositories. JiFUNzeni approach was field-tested though a design-based research intervention conducted in rural western Kenya. The field test included design, development and implementation of a blended learning course for teachers’ professional development utilizing appropriate technologies including tablets powered by solar energy, open educational resources and open source software. One year after the intervention, follow-up interviews were conducted with eight of the ten teachers and two professional development tutors (PDTs) who participated in the research. The findings from the follow-up interviews shared in this paper revealed that: teachers still used cooperative learning and activity-based learning strategies in their teaching. The PDTs on the other hand designed, developed and implemented one other jiFUNzeni blended learning course for twelve teachers in one school in Korogocho slum in Nairobi city. Implementation by PDTs of jiFUNzeni approach confirmed that they had learned through a sustainable way of delivering professional development in challenging educational contexts. The PDTs utilized the instructional design approaches learned through their participation in the research in designing blended learning content, while they also innovated new ways of developing self-study content as an important creative addition to what they had previously learned. Two teenage children participated in digital content development by advising the PDTs on some appropriate ways of applying technology thus, attesting to the fact that digital natives are important reciprocal supporters to digital immigrants and vice versa.

**Keywords:** Appropriate technology, blended learning, challenging educational context, JiFUNzeni approach, offline web content, open educational resources

1. **Introduction**

This paper presents findings on sustainability of one tested innovative way of delivering professional development for teachers in challenging educational contexts. While blended learning to enable teacher’s access professional development has been utilized in many contexts, JiFUNzeni blended learning approach which is the focus of this paper lays emphasis on creating locally relevant content and use of appropriate technology including offline web content, open educational resources (OERs) and solar energy solutions. This blended learning approach is explained in detail after the background section in which the key themes in this paper are presented. The key themes are: blended learning and appropriate technology, professional development and challenging educational contexts.

2. **Background**

The key themes in this paper are presented as background to clarify and ground the themes within available literature as reviewed for this paper. First, clarification of blended learning and appropriate technology is the focus of the following subsection.
2.1 Blended learning and appropriate technology

Scholars have defined blended learning in various ways. For example, Picciano (2009) defined blended learning as a combination of online learning and face-to-face instruction. Other scholars such as Garrison and Vaughan (2008) delineate the components of blended learning stating that it is the fusion of online learning and face-to-face delivery of learning. These definitions of blended learning from the Western perspective are influenced by realities of the context in the western countries. Such realities include: abundant access to electricity on the grid, uninterrupted and cheap Internet connectivity, and access to powerful technologies such as computers and tablets. Thus for scholars from the West, it is quite in order to emphasize access to online experience when defining blended learning.

Defining and implementing blended learning from a challenging context such as rural Kenya, where jiFUNzeni field test was conducted calls for consideration of the contextual realities as well. Thus in a context where there is lack of access to electricity, Internet is not guaranteed, and schools lack basic amenities including clean and safe learning spaces, learning materials such as text books and facilities such as desks, blended learning must be redefined with consideration of the contextual realities. Thus such contexts are characterized as challenging educational contexts in this paper.

Some scholars in Kenya have written about blended learning with reference to contextual realities, yet they do not define it. Gunga and Ricketts (2007) while acknowledging virtual learning as implemented at Kenyatta University through the African Virtual University (AVU), suggested that a blended approach was more ideal because the Kenyan context was not ready for only virtual offering of AVU programs as had been expected, hence face-to-face components were later included. Simiyu and Macharia (2008) suggested that at Moi University, on recognizing the need to include teachers in their degree programs, blended learning approaches had to be utilized. These scholars suggested that the “blend” at Moi University consisted of face-to-face instruction to teachers, combined with online access to course content via communication tools such as email or discussion forums. These two examples of blended learning in Kenya, however do not clarify the understanding of blended learning.

In this paper, blended learning is defined as a deliberate combination of self-directed study of offline content deployed on tablets, with occasional face-to-face meetings, moderated through instructor-led sessions. This definition takes into consideration access to offline professional development (PD) content on tablets combined with teachers’ face-to-face interactions with their peers and instructors referred to as professional development tutors (PDTs). JiFUNzeni blended learning approach emphasizes use of appropriate technologies for each context based on the contextual realities.

Appropriate technology was coined and extensively used by Schumacher (1973). Schumacher identified the characteristics of appropriate technology as (a) simple, (b) small scale, (c) low cost, and (d) non-violent. The United States Office of Technology Assessment further refined the definition of appropriate technology as: (a) small scale, (b) energy efficient, (c) environmentally sound, (d) labor intensive, (e) controlled by the local community, and (f) sustained at the local level (Wicklein, 2005). Sustainability at the local level has been qualified by Batteau as: “Appropriate technologies are ‘appropriatable’ technologies – devices and implements with which users can establish up-close and familiar relationships, so that mastering them no longer seems to be an insurmountable feat” (2010, p. 132).

Appropriate technology in the research reported in this paper refers to those technologies which are simple, small scale, easily connect with the local users and cultures; are sustainable within the local economic circumstances, and inexpensive (Wicklein, 2005). From a general perspective, Batteau asserted that examples of appropriate technologies may include bicycle-driven water pumps for arid regions lacking reliable electric supply or hand-cranked radios that never need to have their batteries replaced. They also include minimally featured cell phones that are more reliable than landline telephones in many challenging contexts (Batteau,
In this paper, examples of appropriate technologies include inexpensive tablets, solar energy, mobile phones and open educational resources (OERs).

Notably, with the expansion of use of social media, tools such as Facebook, Twitter and online blogs are emerging as important tools for learning in challenging contexts. These applications, available on platforms such as mobile phones necessitate a review of online learning due to the affordances for learning on social media. Such appropriate technologies will continue to be useful in providing professional development, which is briefly reviewed in the following section.

2.2 Professional development

Professional development provides teachers with opportunities to reach beyond their current professional repertoire (Joyce, 2004). According to Joyce, teachers are wonderful learners who, when given just a few days of high quality professional development, can enhance their performance and make huge differences for their students. Joyce suggested teachers need help to make changes in their practice in curriculum, instruction and assessing student learning. The help envisioned by Joyce focused on professional development providers availing themselves as working colleagues to inquire with teams of teachers, becoming part of, rather than professional development ‘presenters’ (Joyce, 2004). This implies that professional development providers can no longer claim to be the ones who know and have to present to teachers, but rather consistent with blended learning modalities, there should be opportunity for teachers to take charge of their learning through self-directed study and exchange of ideas in face-to-face sessions.

The Kenyan education authorities recognize the importance of professional development as a potential contributor to change in teaching practice. The Kenyan Ministry of Education identified in-service education for primary teachers as an important component of the comprehensive investment program in education for the period 2005 – 2010 (Akyeampong, et al. 2011). However, although Kenya has an elaborate professional development infrastructure, including teachers advisory (TAC) tutors in the education field offices, not much has been done to institutionalize professional development. Instead teachers’ professional development in Kenya consists of “small usually one shot projects by a variety of NGOs whose focus is usually dictated by the area of interest to the particular NGO” (Akyeampong, et al. 2011, p. 52). The country’s educational aspirations cannot be realized with such unstructured and uncoordinated implementation of PD. Researching alternative ways of delivery of PD such as jiFUNzeni approach could contribute towards institutionalization of PD in such challenging educational contexts, a term which is elaborated in the following section.

2.3 Challenging educational contexts

It is suggested that there is a range of contextual circumstances inherent in educational contexts like the one in the study reported in this paper that would be characterized as challenging educational contexts. While it is acknowledged that there does not appear to be a commonly held definition of the term challenging contexts, there seems to be some consensus that such contexts are associated with high poverty levels (Chapman and Harris, 2004).

Harris (2002) writing on school leadership in schools that might be characterized as challenging contexts, interchangeably used the terms: schools in difficult circumstances, schools in difficult and challenging contexts, schools facing difficult circumstances, and difficult school contexts. The mixture of terms describing schools in similar situations can be very confusing. Harris (2002) pointed to the United Kingdom’s Department for Education and Skills (DFES) designation of ‘schools facing challenging circumstances’ as those in which, among other circumstances, 35% of the students receive free meals, those schools with falling enrolment numbers and those serving inner city communities. The characteristics enumerated in the DFES categorization imply links to high poverty as a condition for designation of ‘schools facing challenging circumstances’.
Challenging educational contexts can be defined as environmental, social, and infrastructural impacts that prevent individuals from reaching their potential and participating in both formal and informal learning (Crichton and Onguko, 2013). The constraints that characterize challenging contexts referred to in this paper include:

- Access to consistently available and affordable electricity
- Access to reliable, unfiltered or censored Internet
- Access to previous formal learning and/or opportunities for ongoing formal learning that support individual learning needs
- Access to non-formal, yet appropriate learning opportunities
- Access to or participation in learning activities due to cultural or religious reasons
- Access to clean water and adequate sanitation
- Access to transportation and mobility
- Access to prior learning
- Other access situations linked directly to poverty (health, fees, low wages, inappropriate clothing, etc.).

The list of constraints above is not exhaustive, yet it suggests the types of challenges faced by learners and educators, including the participants in the study in this paper. The conditions enumerated above are common in many developing countries, thus calling for interventions that recognize the need to address the constraints through deployment of appropriate technologies that take into account the contextual realities. An intervention guided by the activity theory such as JiFUNzeni blended learning approach can enable alleviation of some of the challenges since teachers are able to articulate their needs; motivated to address the needs through active engagement, social interaction and collaborative effort. JiFUNzeni approach is explained in detail in the following section.

3. **JiFUNzeni blended learning approach**

JiFUNzeni approach was initially proposed by our team of scholars and innovators as a conceptual framework for making professional development accessible to over one billion people living off the electricity grid (Jifunzeni, 2010). Jifunzeni is a Kiswahili word that means inviting all to learn. This approach emphasizes working collaboratively with regional partners, to develop digital content relevant to the context. JiFUNzeni approach underscores a needs-based implementation of blended learning for professional development, delivered on appropriate technologies (Onguko, 2012).

There are four components in JiFUNzeni approach. These components are:

- content development;
- appropriate hardware solutions;
- training; and
- access to a content repository.

The four components of JiFUNzeni approach are illustrated in Figure 1. These components include creating digital blended learning resources as PDF readings, video clips, audio podcasts, and pictorial images that are either embedded in HTML content or electronically published (epub) content. Thus JiFUNzeni blended learning is a simple way to digitally **tell**, **watch** a pamphlet, **read** information, and **build** instructional capacity through the thoughtful development and delivery of relevant content, enabled by appropriate technologies (Crichton and Onguko, 2013). Selection of appropriate technology for each context is an important component in this framework. Training of regional teachers as providers of innovative learning content through blended learning
is one of the core components of jiFUNzeni approach. The content developed through jiFUNzeni initiatives will continue to be made available to other users as open educational resources on a content repository available at www.jifunzeni.com.

Figure 1: Components of jiFUNzeni approach (Source: www.jifunzeni.com)

Initially jiFUNzeni blended learning approach was a theoretical proposition that needed to be tested in the real world where solutions to professional development needs were required. In summer 2010, jiFUNzeni approach was piloted with six teachers in Nairobi, Kenya to establish whether jiFUNzeni as a theoretical proposition could be implemented in practice in an urban context before actual deployment in a rural setting without electricity. After the success realized through the pilot, jiFUNzeni was then deployed for field test in rural western Kenya, which is the focus of the research in this paper.

JiFUNzeni approach is grounded in activity theory (Engestrom, 1987) complemented by self-directed theory of adult learning (Merriam, 2001) and situated learning theory (Lave and Wenger, 1991). Activity theory provides for a needs driven and goal directed process through tool mediation, and entails division of labour and isolation of partial tasks implemented by participants in a community of relationships. Key features of activity theory are active engagement and social interaction, which was the basis for teachers during field test of jiFUNzeni approach to collaboratively work with each other, studying through appropriate technologies to inform their teaching practices. Situating the field test within their work-context enabled teachers to implement teaching strategies they studied in the content i.e. cooperative learning and activity-based learning.

4. Research methodology

The research in this paper used qualitative research specifically design-based research paradigm. In conducting design-based research according to Walker (2006), a researcher’s rigorous analysis of a learning problem leads to specific ideas for intervention. “Designers then build systems that use information technology to build specific teaching and learning materials and methods designed to realize learning gains predicted by theory and research (Walker, 2006, p. 11).” Walker suggested that if the theoretical analysis is right then these interventions ought to give markedly more effective results. Thus, it has been argued, literature on design research is unanimous that the goal is useful innovation with particular emphasis on investigating the possibilities for educational improvement by bringing about new forms of learning in order to study them (Schwartz, Chang and Martin, 2008). Thus jiFUNzeni blended learning as a theoretical proposition was actualized through design based research reported in this paper.
The data in this paper was drawn from interviews with the participants and documentation of design artifacts. Interviews conducted one year after the initial field test of JiFUNzeni approach and documented design artifacts of a second intervention implemented by the PDTs in Korogocho in Nairobi are the sources of data shared in the paper.

Design artifacts were documented by the PDTs during design and implementation of PD content. Documentation of design artifacts is a means of providing insights into the ‘making of’ the design (Kelly, Lesh and Baek, 2008). Kelly, et al. explain that the process “involves not simply sharing the designed artifact, but providing rich descriptions of the context, guiding and emerging theory, design features of the intervention and the impact of these features on participation and learning” (2008, p. 13). The PDTs documented the design artifacts some of which are shared in Figures 2 and 3 in this paper. Following the brief presentation of research methods, the data is presented in the following section.

5. Presentation of results

The results discussed in this section are drawn from data gathered one year after JiFUNzeni field test, with a view to getting evidence of the potential for sustainability of JiFUNzeni blended learning approach. The results are presented at two levels: first, findings from interviews with PDT’s on design and implementation of JiFUNzeni blended learning in Korogocho slum in the city of Nairobi; and secondly follow-up interviews with eight teachers’ one year after jiFUNzeni field test in rural western Kenya.

5.1 PDTs’ design and implementation of blended learning

Two PDTs who had learned through JiFUNzeni field test retained the appropriate technologies including tablets, solar charging equipment and flip camera for their use in designing and implementing other blended learning programs for teachers’ professional development. They subsequently worked with twelve teachers in one school in Korogocho slum of Nairobi to implement one blended learning course on assessment of learning. Findings from interviews with them are shared in the following subsection.

JiFUNzeni approach in Korogocho

At interviews with PDTs, they stated that they learned through JiFUNzeni field test research and thus designed and implemented JiFUNzeni approach without the support of the researcher. Commenting on their experiences in blended learning, PDT1 said:

Starting with the design, it was tough. Tough because, you see the previous year we were together [with researcher] and therefore if there was a little problem we had someone to troubleshoot. When we got a problem, we had to sit back and ask ourselves, ok! So where do we go from here? What do we do? And for that reason it took us slightly longer to write the program - design it. But for me the joy was, it is true I did learn because even without having someone to fall on back immediately, in this case, to fall back on you [researcher] and ask what do we do now? We still were able to go on and do the design and in fact learn new ways; some short cuts to what we did (Interview).

Further discussion with the PDTs on creation of multimedia content revealed that their two teenage children guided them on use of the tools at their disposal for creating content. They called the two children “digital natives” based on the concept of digital natives popularized by Prensky (2001). PDT2 stated, “We had the phone, then we also realized that we could use the laptop for audio recording. In fact the laptop [use for audio
recording] we were reminded by the digital natives” (Interview). PDT1 clarified: “The natives are my daughter and my colleague’s son” (Interview).

The “digital natives’ contributed to efficiency in application of technology. PDT2 articulated the role of the teenagers as:

What they did, we came up with a story board and we thought the part you [researcher] played when we recorded the audio content needed another voice, so we used Jay’s voice to role-play some parts like the introduction. And then Penny was the one who was handling the gadgets. So there was division of labor. And they were the ones who reminded us we could use Bluetooth to transfer [multimedia files]. Like when we had finished [compiling] the course, we were going to export from one laptop to the other. We were thinking of using email. So we were busy looking for email, connecting to the Internet to email to each other then the two of them laughed and said what are you people talking about. These laptops have Bluetooth! (Interview).

Further discussion with the PDTs revealed that the ‘digital natives’ contributed more to content creation. As indicated by PDT1 in this excerpt:

Even when recording audio, we tried the telephone and it was not working. Then they said, if it is not working, use the laptop. The laptop has a recorder why don’t we just try that. And you know when you imagine that this is an 18 year old and a 13 year old guiding us, then we truly could say these are digital natives (Interview).

The blended learning content designed by the PDTs is evident in the screenshot in Figure 2. It was heartening to realize that PDTs referred to division of labor when talking about their role and that played by the ‘digital natives’ because in jiFUNzeni field test, division of labor was an important component together with development of a community as in activity theory (Engestrom 1987) which is an important guide for the jiFUNzeni blended learning approach.

![Screenshot of offline web content](https://www.ejel.org)

**Figure 2:** Screenshot of offline web content

PDTs discovered new ways of developing multimedia content apart from the initial processes during the field test of jiFUNzeni learning approach:
On downloading videos from YouTube, we did not go through the process we had gone through earlier. We went to Edutopia website and it was clearly advocated that we could use their resources and share or use their material for educational purposes. The YouTube videos just downloaded automatically (Interview, PDT2).

The explanation on free access to web content from Edutopia website was important at this juncture because in the initial field test of jiFUNzeni, we had to seek for permission to use content from Latika Roy Foundation in India via email. Access to open content that could be repurposed for each context is an important part of jiFUNzeni approach as it is proposed for challenging educational contexts that lack educational resources among other challenges.

On implementation of jiFUNzeni approach in Korogocho, the PDTs expressed their satisfaction in the interview: The theme of our course was assessment. We had previously had a one-day workshop with the teachers and they had requested us to talk about assessment. We designed a course that would take six weeks and we had three units. When we met the teachers on the first face-to-face, we had to introduce them to the technologies including how to use them. The school had electricity, which they used to recharge the tablets. (Interview, PDT2).

Clearly the two PDTs had changed their delivery of PD from entirely face-to-face offering to blended mode as suggested above. It is noted here that the teachers had requested them to “talk” about assessment, but then PDTs went to the teachers with more resources in various formats that went beyond just their “talking” to them. PDT2 described the processes and the activities they engaged in.

We requested the teachers to allow us to visit them in their classrooms for observation just to see if they were able to implement the content they were reading, in their teaching. At least we saw each and every teacher in their classrooms, some of them even three times. The teachers were drawn from a whole range of sections from baby class to grade seven, which was the highest grade (Interview).

The content provided by the PDTs spoke to teachers through the audio and video content, teachers read content through self-directed study as in the quote above rather than PDTs being the only ones “talking” to teachers. PDT1 explained the value of blended learning to teachers from a general perspective.

One of the things we have done before, are workshops with teachers. In those workshops, we just relied on face-to-face and they would come where we are. One of the successes of blended learning is that it allows the teacher to remain in the classroom yet at the same time be able to do professional development. We tried to gather some data about these teachers. Majority of them had not accessed PD before. When we asked them why, they said that with the work they have, it is not easy for them to go out for professional development because they have a lot of work in school, they have responsibilities at home and it is also expensive. So by doing blended learning you allow that teacher not to withdraw from the classroom, yet at the same time to get opportunity to grow as a teacher through professional development (Interview).

The interview with PDTs on design and implementation of jiFUNzeni approach on their own, in a different context from the field test site suggests they learned through their involvement in field test. These are hallmarks of a sustainable approach to provision of PD in such challenging educational contexts. Figure 3 is evidence of offline content on the tablet used for self-directed study.
In the following section, data from teachers’ interviews is presented.

*Teachers’ views during follow-up interviews*

Eight of ten teachers who participated in jiFUNzeni field test in western Kenya were still teaching in the research school when the follow-up interviews were conducted. The objective of conducting the interviews was to establish whether one year after the intervention, teachers still applied teaching strategies learned through jiFUNzeni approach. This was in a bid to identify whether indeed jiFUNzeni could be a sustainable approach to providing professional development in a challenging context.

It was not, however, possible to observe teachers applying the teaching strategies in their teaching because the researcher’s visit coincided with the examinations period just before school holidays at the end of term two of 2012. The eight teachers responded to the follow-up interview questions. When asked whether they still used the teaching strategies they had learned a year earlier, Nita responded, “Yeah! We still use especially group work [cooperative learning]. I even have some books here I am marking arising from work done by my students in groups” (Interview). This response implied teachers continue to apply cooperative learning, which was one of the teaching strategies introduced to them through jiFUNzeni approach.

Asked if they could remember what the teaching strategies they learned one year earlier were, Churchill stated: “I remember we looked at different approaches to teaching and learning, specifically cooperative learning and activity-based learning such that the children interacted and learned from each other” (Interview).

When asked how the strategies were helpful in their teaching, Churchill observed:

*These [strategies] were very helpful because use of cooperative learning enabled the teacher to ease the burden of being the sole presenter and were able to engage the learners. Learning became participatory; there was peer-learning and sharing for example, through use of round-robin approach (Interview).*

On responding to the same question, Loise stated, “through the use of teaching and learning aids [learning materials] the learners were able to manipulate some of the materials and this helped in their remembering of what was learned in class” (Interview). The responses by teachers suggest that they continued to engage students as active participants in learning as opposed to the passive participation students were exposed to before the intervention.

Mika also followed up in responding to the same question emphasizing:
With the approaches we were able to engage the learners and make learning real. When we use examples we make learning abstract but now using the approaches we make use of locally available materials all found within the school and make learning real (Interview).

Mika’s response suggests that by teachers engaging their students in cooperative learning and activity-based learning, they enabled the students to engage in learning by doing, thus “making learning real”. Another question was on the successes the teachers had had so far in using the teaching strategies. On this, Nita stated:

In a nutshell there is some achievement, for example, you will give them an assignment. When they work individually, they don’t score as high as when you allow them to discuss freely then they come to a conclusion. So you find that when they work as a group the scores are high because many heads are brought together, they share ideas before they come to a conclusion. They go to the extent of having to appoint a chairperson to control the discussion, a secretary to write. At least they develop self-esteem to work (Interview).

Nita’s response not only suggests that students learn better when they engage in discussions and doing activities with others, but also that they gain by taking on responsibilities such as leading in the cooperative groups. On challenges encountered in using the teaching strategies introduced to them through the research, Emah stated:

On the use of the materials, sometimes you find that you have to purchase these materials. Some of those locally available are not very good; are not very reliable, you need to purchase them and yet we lack the resources (Interview).

Teachers were also asked to share the surprises encountered in implementing teaching strategies over the year. Nita stated: “There are some surprises. Just the other day, Loise was complaining that parents couldn’t give a spoonful of sugar and salt when it came to mixing in science. So we get surprised because the parents are not supportive”. On the same issue, Loise stated:

We also need support. You see when a teacher requests for a tea-spoon (of sugar) from every child, at the end of the day parents think you are collecting sugar for use in school. They even don’t see the need. After all they understand that we have free primary education in Kenya so nothing should come from them. The parents think if you get a spoon of sugar or salt from every child, then you have so much sugar or salt. If you tell them: ok I want everybody to contribute a shilling we buy the items, you know even getting that shilling is very hard (Interview).

The responses by Nita and Loise suggest a need to sensitize the parents and school community members on their support responsibilities for the teaching and learning process. For schools in challenging educational contexts like the ones involved in the research in this paper, it is always a problem to find learning material. Contribution by the parents towards learning resources like sugar as mentioned in the excerpts is crucial for authentic and practical learning. Otherwise learning remains abstract.

A detailed discussion of the findings follows in the next section.

6. Discussion

Data gathered in interviews one year after jiFUNzeni field test led to the results presented in the previous section. The study revealed that for the PDTs who already offered school-based face-to-face professional development to fellow teachers, it was easier to improve on delivery of PD by shifting to blended delivery format. PDTs in the study first engaged in a two weeks usability test of jiFUNzeni approach, then together with the researcher designed and implemented the field test of jiFUNzeni approach (from February to June 2011) and were subsequently ready to implement one such blended learning course with teachers in a school in...
Korogocho on their own. This attests to the need to empower teachers in challenging contexts to enable them utilize appropriate technologies in providing professional development to their colleagues.

Lessons so far learned from implementation of jiFUNzeni approach in two sites point to the importance of awareness of contextual realities in implementing PD through blended learning. It is clear that each context presents variations in terms of infrastructural and professional development needs. For example, in the rural context of western Kenya where electricity was not available, jiFUNzeni approach was implemented with power harvested from solar energy. However, when implementing the second jiFUNzeni blended offering in Korogocho in Nairobi, teachers had access to electricity. While the same tablets were used in both sites, the power options differed on the basis of the contextual realities. This reiterates the importance of considering the jiFUNzeni components, which emphasize training local experts while selecting the most appropriate technology options. In terms of professional development, the teachers in rural western Kenya were in need of PD on teaching large class sizes while teachers in Korogocho needed PD on assessment for learning. These were outcomes of the needs assessment done before the interventions at both sites.

An important addition to jiFUNzeni approach by the PDTs realized through the offering in Korogocho was involvement of teenage children (referred to as digital natives in this paper) in instructional design. While they did not contribute towards generating content, the teenage children were however, very instrumental in supporting PDTs in terms of technology stewardship. The digital natives who are so-called because they were born in times when the current high levels of digital technology in society was already upon us, speaks to the reality that teachers and parents have no choice but to also learn from the younger generations. The quality of the multimedia course content was for sure boosted by involvement of the teenagers, as PDTs readily accepted and indeed learned from their input. Teachers and parents no longer have monopoly of knowledge and skills arising either from experience or training. Young children are able to share their knowledge and skills owing to the times in which they live.

For the interviews conducted with teachers one year after jiFUNzeni field test in rural western Kenya, it was apparent that the teachers learned important teaching strategies, which they continue to use in their classrooms. Teachers' responses at post-intervention interviews held after one year indicated that they continued to use cooperative learning and activity-based learning strategies. I argue that providing PD for teachers in work-based environments in their schools and classrooms has an advantage of providing real-life experiences that can last longer in their practice. If teachers were engaged in PD on activity-based learning and cooperative learning strategies in a traditional professional development session where PDTs invite teachers to “talk” to them in a face-to-face course away from their schools, implementation in classrooms would have been difficult.

The findings reported in this paper confirm that jiFUNzeni, which was initially presented as a theoretical proposition was actualized in practice as evident from the two sites where it has been implemented. Scale up of jiFUNzeni blended learning approach is the next step of action as we are proposing to establish JiFUNzeni Innovative Learning Centre (JILC) at our university. The proposed JILC will act as an incubator for best practice in applying appropriate technologies in teaching and learning in challenging educational contexts. This is a task we look forward to with a lot of enthusiasm.

7. Conclusion

This paper has illuminated the background to jiFUNzeni blended learning approach, data arising from its implementation and its potential for sustainability. Challenging educational contexts like the ones described in this paper i.e. rural schools and schools in slum areas in cities, require specific contextually relevant and driven interventions such as jiFUNzeni blended learning approach. It is gratifying for me to note that jiFUNzeni blended learning approach; a theoretical proposition has been implemented in practice in the challenging educational contexts with evidence of potential for sustainability based on the findings presented in this
paper. It is with great satisfaction that I look forward to sustained scale-up of jiFUNzeni approach as one of the champions of the approach.

References


Note: I acknowledge support from Lucy Jepchumba and Petronilla Gaceri, who allowed me to use the artifacts in Figures 2 and 3 from their implementation of jiFUNzeni in Korogocho, Nairobi.
Addressing Diversity in Health Science Students by Enhancing Flexibility Through e-Learning

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Abstract: The technological advancements for teaching and learning sciences for health science students are embedded in the Thalluri-Penman Good Practice Model, which aims to improve the learning experiences of science students and increase student retention and success rates. The model also links students from urban and rural areas, studying both on- and off-campus, with the university campus and with co-students and is primarily structured to boost students’ confidence in studying sciences. This paper investigates the introduction of online initiatives, namely, electronic learning communities, online self-assessments, virtual classroom, and the inclusion of social media Facebook to offer practically oriented science learning to urban and regional science students. It examines the issues surrounding the implementation of these technological innovations by identifying the perceptions of the students about their use, illuminating their impact on students, and clarifying the practical issues encountered in the application of these online initiatives. A descriptive analytical approach was used to explore the experiences of students in the use of these innovations. Findings of the evaluations show that the technology exemplified in this paper provides: an approximation of face-to-face lecturing when it is not possible for a lecturer to be at the same site as the class; enhance communication between students and lecturers; and help students access, collaborate and interact with each other. The use of technology that is carefully considered in each stage of the program has been shown to enhance the quality of university teaching and learning, allowing students’ greater accessibility, flexibility and interaction.

Keywords: online technology, e-learning, flexibility, learning and teaching

1. Introduction

It has been observed for many years that health science students undertaking science-based programs are confronted by educational challenges. The branches of science dealing with structures, functions and disease processes of the body and management of conditions appear to be stumbling blocks for students. Learning science courses is not easy (Strube, Thalluri & Kokkinn 2004). Enormous amounts of information must be remembered and reading science literature is difficult.

Moreover, increased access to higher educational opportunities in health science courses has led to diverse equity student cohorts with a wide range of academic abilities. Some students, particularly those from regional areas with limited choice in school subjects, may have learning difficulties often associated with a poor background in biology and basic sciences essential to understanding the human body. Students who fail their sciences are delayed in their academic progress and may even decide to leave the program altogether. Il ling (1998, cited in Zeegers and Martin 2001), stresses the costly implications of student failure rates at university. Consequently, our University has organised campus- and program-specific systems and processes to help students succeed in their science courses. Some of these include: orientation activities to introduce new students to library facilities and the online environment; the employment of learning advisers who work closely with students to enhance their academic skills; and adopting appropriate pedagogies in teaching science courses. Another strategy is the optimal use of information and communication technology (ICT) by making learning resources available on-line and encouraging discussion groups that allow students greater interaction.

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The heterogeneity of our students and limitations in rural and regional areas necessitate different and creative strategies to assist students to achieve academic success. Contemporary teaching and learning models in health science that can accommodate such diverse requirements are imperative. The Thalluri-Penman conceptual model is one such framework. It represents the culmination of 45 years of teaching experience combined and the development of innovative learning initiatives designed to contribute to individual student success and positive learning experiences in studying health sciences in higher education.

The Thalluri-Penman model is student-focused and an interactive framework for teaching and learning health sciences. The model aims to guide the delivery and coordination of science courses in order to improve students’ positive learning experience and improve student retention and success rates. The approach also links students from urban and regional areas, studying both on- and off-campus, with the university campus and with fellow students. It is structured to: boost students’ confidence in studying sciences; provide flexibility and instant feedback to large classes using the latest technology; increase students’ capacity to succeed as university students; create and enhance students’ positive and satisfying learning experience; reduce students’ fears about studying science; and minimise the risk of students dropping out of science-based university studies. The model highlights the optimal use of ICTs, specifically the maintenance of electronic learning communities, online self-assessments, virtual classroom, and inclusion of social media. The description and analysis of the impact of these ICT initiatives is the focus of this paper. The paper concludes by discussing the implication of the initiatives in the educational preparation of students.

2. The Thalluri-Penman conceptual model

The application of the Thalluri-Penman conceptual model for learning and teaching science successfully begins at the time of students’ first encounter with the university and extends right through to the completion of their health science program. See Figure 1. Emphasis is placed on achieving sound learning outcomes in such areas as anatomy and physiology, pathophysiology, pathology, microbiology and pharmacology, relating to various health science programs, such as Nursing, Medical Radiation, Physiotherapy, Occupational Therapy, Pharmacy and Podiatry, offered by the University of South Australia (UniSA). The model has evolved from listening to students talking about their learning experiences, looking for insights to help them engage more effectively with their studies, and devising ways to make this engagement happen. The model therefore incorporates features that students have found empowering and relevant to their learning needs.

Figure 1: The Thalluri-Penman conceptual model for the successful learning and teaching of science
Legend: IBL (inquiry-based learning); PBL (problem-based learning); CBR (case-based reasoning); ICT (information and communications technology)

The key features of the model include a number of staged initiatives across students’ health science undergraduate program. Depicted in the innermost sphere is the core of the conceptual model – the students with their diverse backgrounds and needs trying to learn sciences. Reflected in the second sphere are the pedagogies such as inquiry-based learning (IBL) and problem-based learning (PBL) on which science teaching is based.

In IBL, learning is organised around the individual rather than the content and students learn problem-solving skills, informal reasoning as well as constantly seeking relevance and connections (Duffy & Cunningham 2001; Stripling 2003). IBL falls under the constructivist approach characterised by collaboration, active engagement and personal relevance, amongst others (Savery & Duffy 1996). PBL, on the other hand, is an instructional methodology that allows the attainment of knowledge and skills through real practice situations (Williams 2001). The learners are immersed in the PBL context, requiring them to learn the complexities of an authentic problem, search for connections across different bodies of knowledge, recognise what they know and what they need to know about a problem, and suggest solutions to a given problem derived from the workplace (Gonzalez & Salmoni 2008). In the PBL process, students go through various stages, such as formulating explanations, clarifying personal understanding, critiquing resources, identifying gaps in knowledge, and synthesising what has been learnt and how best to approach the problem (Williams 2001).

Symbolised in the third sphere are pre-university activities for beginning students. In particular, the three-day to a week-long preparatory course called Preparing for Biosciences, is offered to students to introduce them to the language, basic concepts, and clinical usefulness of biosciences (Penman 2005). This short course currently targets incoming students, many of whom are transitioning to university study from non-traditional backgrounds and who have diverse equity characteristics and learning needs.

For first-year students, a student-driven peer-mentoring program (also called student coaching scheme and Golden Key tutoring scheme) is available and this is represented in the fourth sphere of the conceptual model. This initiative provides opportunity for second- and third-year nursing students, who have achieved highly satisfactory grades for all bioscience courses, to receive training to act as mentors to first-year students and to those who have been identified as ‘at risk’ in their bioscience and pathophysiology studies (Penman & White 2006; Thalluri, Kokkinn & O’Flaherty 2008).

Embedded in the fifth sphere is the optimal use of ICT for all levels of students. Of the many ICTs used and integrated in course delivery, the electronic learning communities, online self-assessments, virtual classroom and the use of Facebook, are examined for this paper.

The final and outermost sphere in the Thalluri-Penman model depicted in Figure 1 symbolises the contextualisation of science, where science is applied specifically to the roles of the future health professionals, illustrating the implications of science for real-life environments and future practices. In addition, students are taught to think about their thinking and learning, and develop meta-cognitive skills which will prepare them for life-long learning. Skills that are metacognitive in nature include: planning the way to approach a learning task, monitoring comprehension, and evaluating the progress towards the completion of a task; they include knowledge about when and how to use particular strategies for learning, problem solving or creative and analytical thinking (Metcalf & Shimamura 1994).
3. Information and communications technologies used

The electronic learning communities (also referred to as online discussion groups), online assessment and online problem-based conferencing via discussion groups are part of the UniSAnet online learning environment developed in house at the university.

The electronic learning communities have been used in various fields, incorporating both synchronous and asynchronous electronic communications. E-learning and e-teaching is possible and potentially useful for interaction and collaboration, which are crucial for effectively engaging off-campus students and minimising student disengagement. The creation of electronic learning groups, which are carefully designed learning communities whose members work together online to benefit each other, is central to successful engagement in science materials. These have been shown to supplement face-to-face teaching and foster further learning beyond the classroom (Penman & Cook 2009; McCarthy, Smith & DeLuca 2010).

Online self-assessment is a mechanism of ongoing formative assessment for first-year students in nursing and midwifery, and other levels as well. This initiative encourages students to monitor their own progress in the bioscience and clinical science courses and offers complete flexibility in the manner in which students can undertake the assessments. Assuming responsibility for one’s own learning is a critical aim of tertiary education, and one which underpins the capacity for students to engage with lifelong learning and exercise good judgement about their body of knowledge, consequently assisting in the development of two of UniSA’s graduate qualities (UniSA 2009a).

Virtual classroom is a conferencing technology conducted in cyberspace allowing students and staff to collaborate with audio, video and graphics using a range of tools and function (UniSA nd). It’s features include: group text, audio and video chat, presentation sharing, whiteboard collaboration, group polling and file sharing. Virtual classroom is used as a learning space where nursing students construct knowledge in the area of mental health conditions, psychotropic agents and other treatment modalities. Students use the virtual classroom to explore topics, clarify and confirm understandings, hone assessment skills and recommend courses of action for clients.

Finally, the use of Facebook is important to science learning, especially for regional students. Facebook is an online social network site where personal information and photographs are shared and where groups may be formed to connect people. Pre-determined real-life cases with problems and corollary questions are provided to students via Facebook. A case reports typically on a client presenting to a hospital with various medical complaints (Ward & Hartley 2006). Students attempt to solve the general problems of disease causation and suitable interventions. Discussions are threaded so that learners can follow successive postings to a topic.

4. Context

First- and second-year nursing students evaluated these technological advances from 2008 to 2013 in a metropolitan and regional campus of our university. Thirty-four (n=34) second-year off-campus nursing students evaluated the electronic learning communities created. One-hundred twenty-six (n=126) first-year nursing students were surveyed for the online assessments. Twenty-four (n=24) first-year off-campus nursing students were invited to comment about the use of virtual classroom, while seventeen (n=17) second-year nursing on-campus students were surveyed about their perceptions on the use of Facebook.

5. Methodology

Survey methodology was used to evaluate the different ICT initiatives.

The electronic learning communities were evaluated by inviting students to respond to questions on how discussion pages helped them in their studies and difficulties they encountered. The invitation posted on the
discussion pages at the conclusion of the science course included an explanation of the purpose of the survey. E-mail was used to send follow-up reminders to participate in the survey.

The use of online self-assessment and virtual classroom were evaluated via the university’s course evaluation instrument (CEI) and ‘My course experience’, consisting of core Likert-type questions to which students agreed or disagreed. Optional questions were attached to the CEI specifically for the online self-assessment querying the value and impact of the ICT on the students.

On the other hand, the use of Facebook was evaluated by a 25-item Likert and open-type questionnaire posted to students at the conclusion of the course. This post-intervention questionnaire covered various aspects of students’ Facebook experiences. Students were asked to indicate the extent of their agreement with statements describing their experiences. See Table 4. Other items explored the best things about the use of Facebook, suggestions for improvement, most important outcome gained, and additional comments. See Table 5.

Survey information given to the students included a statement regarding the voluntary nature of participation and assurance of confidentiality. Completion of the surveys was taken as consent.

6. Students’ perceptions of the technologies

Results of the evaluations of these ICTs are reflected in the following tables.

The evaluation of the electronic learning communities showed that these were most favourably rated by the students. Of the 78 students enrolled in the science unit using discussion boards, 34 responded to the survey, for a 44% response rate. All respondents (n=34) agreed that the discussion pages had helped them in their study of the course. See Table 1.

**Table 1: Student perceptions about electronic learning communities**

<table>
<thead>
<tr>
<th>Question</th>
<th>Comments (representative responses)</th>
</tr>
</thead>
</table>
| How have the discussion pages helped you? | “daily contact with lecturer”
| | “helped to keep on track”
| | “allowed students to share techniques to understand the material”
| | “provided challenge”
| | “personal connection”
| | “support and guidance”
| | “learning deep and meaningful”
| | “linking of knowledge and experience”
| | “I can honestly say it was fun”
| | “reflection”
| | “enriched by others’ personal experience”
| | “quick responses to any queries”
| | “additional revision questions” |
“keeping in touch with other students”
“what keeps me going and are a great support ... as sometimes one feels so isolated”
“preparing us for exams”
“makes me feel part of something special”
“[lecturer] was monitoring our progress”

Online self-assessment tests have many positive outcomes for student-centred learning and improved student feedback, according to the 126 survey respondents. See Table 2.

**Table 2: Student perceptions about online self assessment**

<table>
<thead>
<tr>
<th>Statement</th>
<th>Agree to strongly agree</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Online self-assessment quizzes give me instant feedback.</td>
<td>91</td>
<td>72</td>
</tr>
<tr>
<td>Online self-assessment quizzes help me to focus on the areas to learn.</td>
<td>79</td>
<td>63</td>
</tr>
<tr>
<td>Online self-assessment quizzes are good practice to prepare for fortnightly tests and the final exam.</td>
<td>83</td>
<td>66</td>
</tr>
<tr>
<td>Flexibility of time enables me to practise online self-assessment quizzes often.</td>
<td>82</td>
<td>65</td>
</tr>
</tbody>
</table>

Of the 24 students enrolled in the unit who participated in the virtual classroom, 7 commented on the technology, for a 29% response rate. Overall, the students articulated positive impressions of this initiative, however, it seemed that timing and access to the recordings were problematic. Table 3 summarises the survey results.

**Table 3: Student perceptions about virtual classroom**

<table>
<thead>
<tr>
<th>Question</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>How has the virtual classroom helped you?</td>
<td>“increased my interest in the topic, though couldn’t attend all because of work”</td>
</tr>
<tr>
<td></td>
<td>“am enjoying the course”</td>
</tr>
<tr>
<td></td>
<td>“greater understanding and contact with lecturer”</td>
</tr>
<tr>
<td></td>
<td>“looking forward to more classes”</td>
</tr>
<tr>
<td></td>
<td>“assisted my learning and made me feel part of the group”</td>
</tr>
<tr>
<td></td>
<td>“I couldn’t access any VC recordings for mental health, whether by Joy or any other teacher - very frustrating.”</td>
</tr>
<tr>
<td></td>
<td>“I could not access tutorials at all... they were blocked for the whole study period.”</td>
</tr>
</tbody>
</table>

The responses evaluating the importance of Facebook within the second-year student cohort in Scientific Basis in Clinical Practice indicated the beneficial effects of the technology for students’ academic experience and satisfaction. A survey of ten students from a total of seventeen internal students (representing 59% response rate) revealed that Facebook gave students flexibility, provided opportunities to learn and work with peers and
interact with the lecturer, and increased their interest in the subject. In fact, students concluded that it was an innovative way to learn, recommending the initiative to other students. See Table 4.

**Table 4: Student perceptions about Facebook**

<table>
<thead>
<tr>
<th>Statements for rating agreement</th>
<th>Strongly agree</th>
<th>Agree</th>
<th>% Combining Strongly agree and agree</th>
<th>Neutral</th>
<th>Disagree</th>
<th>Strongly disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>Facebook gave students flexibility in their learning.</td>
<td>4</td>
<td>6</td>
<td>100</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Facebook provided me opportunities to learn with peers.</td>
<td>6</td>
<td>4</td>
<td>100</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Facebook provided me with the opportunity to work with others.</td>
<td>4</td>
<td>6</td>
<td>100</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Facebook provided me with the opportunity to direct my own learning.</td>
<td>8</td>
<td>80</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>The Facebook initiative facilitated the development of lifelong learning skills.</td>
<td>8</td>
<td>80</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>As a result of my Facebook experience, I engaged well with the course content.</td>
<td>5</td>
<td>3</td>
<td>80</td>
<td>1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>There were many opportunities for me in learning this medium of learning and teaching.</td>
<td>4</td>
<td>6</td>
<td>100</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>The initiative increased my interest in the subject.</td>
<td>10</td>
<td>100</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>The Facebook initiative allowed me to synthesise my past and present knowledge.</td>
<td>3</td>
<td>30</td>
<td>7</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>The initiative further honed my research skills.</td>
<td>6</td>
<td>60</td>
<td>4</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>The Facebook initiative was adequately introduced.</td>
<td>4</td>
<td>4</td>
<td>80</td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>The duration of involvement and attention required for the Facebook initiative was</td>
<td>10</td>
<td>100</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
The Facebook initiative assisted my learning about the topics. | 3 | 6 | 90 | 1 |
The Facebook initiative provided me opportunities to interact with the lecturer. | 8 | 2 | 100 |
It provided me opportunities to learn from my peers. | 8 | 1 | 90 | 1 |
The Facebook initiative was a pleasant learning experience. | 4 | 4 | 80 | 2 |
The initiative was a good substitute for classroom. | 4 | 40 | 2 | 2 | 2 |
I found the use of Facebook an effective way to learn. | 6 | 2 | 80 | 2 |
I found the use of Facebook an innovative way to learn. | 4 | 6 | 100 |
Overall, the use of Facebook enhanced my understanding of disease processes. | 8 | 80 | 2 |
I recommend this initiative to other students. | 8 | 2 | 100 |

Table 5 summarises the results from the open questions querying about students’ perceptions about Facebook.

**Table 5:** Post-intervention responses from open questions (Perceptions about Facebook)

<table>
<thead>
<tr>
<th>Open questions</th>
<th>Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>The best things about the use of Facebook are:</td>
<td>Continuation of learning outside of class room time</td>
</tr>
<tr>
<td></td>
<td>Interaction with peers and lecturer</td>
</tr>
<tr>
<td></td>
<td>Instant feedback</td>
</tr>
<tr>
<td></td>
<td>Quick replies from other peers and lecturer</td>
</tr>
<tr>
<td></td>
<td>Easily accessible.</td>
</tr>
<tr>
<td></td>
<td>Able to share and access information freely.</td>
</tr>
<tr>
<td></td>
<td>More contact with peers and lecturer with flexible hours.</td>
</tr>
<tr>
<td></td>
<td>Gives students the opportunity to learn from each other and discuss uni related issues.</td>
</tr>
<tr>
<td></td>
<td>It gives a glimpse of how and what other peers are thinking, so any input I make may have a positive impact. Also, to our learning by getting feedback,</td>
</tr>
</tbody>
</table>
also, group study could be achieved.

<table>
<thead>
<tr>
<th>Some things that I think would improve future offerings are:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Having a Facebook learning page for each course</td>
</tr>
<tr>
<td>Clarify more fully the use of this program to enhance the communications between students to ensure their understanding and progress.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>What was the most important outcome gained from this initiative?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Communication with classmates</td>
</tr>
<tr>
<td>Instant feedback on all questions about the course or other subjects from Joy and peers.</td>
</tr>
<tr>
<td>Extra information from lecturer</td>
</tr>
<tr>
<td>Closer relationship with lecturer, I felt more at ease and could ask questions any time which helped my learning.</td>
</tr>
<tr>
<td>It gave opportunity to learn if used properly. I saw it as giving several opportunities to students and their lecturer.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Additional comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>I am not an avid user of Facebook. However, this experience has been a positive experience and has encouraged me to use Facebook as a learning tool, and a tool to further my involvement with groups associated with nursing.</td>
</tr>
<tr>
<td>Using Facebook for me was excellent as I live away and travel to campus, so this was a quicker way to keep in contact and gain info from other peers and the lecturer.</td>
</tr>
<tr>
<td>Students submitted their portfolios for perusal which was good but I expected more discussion on topics from peers.</td>
</tr>
</tbody>
</table>

7. Discussion

This paper highlighted the use of ICTs, which is a significant part of the Thalluri-Penman good-practise model for successful learning and teaching of health sciences. The Thalluri-Penman conceptual model is premised on the belief that developing and implementing innovative learning initiatives for commencing and continuing health science undergraduates can significantly contribute to individual student success and positive learning experience. The model embraces electronic learning (e-learning); it provides ‘new, interesting, rewarding, exciting and effective’ way of learning (Santy & Smith 2007, p. 1). E-learning incorporates ICT to enhance learning and teaching and networking is an essential feature of e-learning. While e-learning is similar with distance learning in purpose, it is different because it uses online communication tools that keep students engaged with fellow students, lecturers, and course content. Best of all is the 24-hour sharing of information and communication between learners and quick access to learning materials.

However, in accordance with university best practice in teaching, it is important that academics continually evaluate each innovation that they undertake. Evaluation of the ICTs is crucial in order to optimise the use of the technology and continue improving on it. It is important also to meet the needs of students and lecturers, gain feedback, minimise expense and enhance course delivery.

8. Benefits of ICTs according to the students

The results of the evaluation of e-learning communities indicated that they were beneficial for various reasons and these could be categorised as intrapersonal and interpersonal benefits. Intrapersonal benefits included:
enabling “learning [to be] deep and meaningful”, “[helping] to keep on track”, allowing “daily contact with lecturer”, receiving “quick responses to any queries”, “[providing] challenge” and “personal connection” and making readily available “support and guidance”. Interpersonal benefits included: “[allowing] students to share techniques to understand the material” with each other, being “enriched by others’ personal experience”, “keeping in touch with other students” and providing support “… as sometimes one feels so isolated.”

Likewise, there were many personal benefits derived by students in participating in online self-assessments. Their responses were grouped under the following: taking responsibility for their own learning, obtaining feedback on their understanding, contributing to further knowledge development, inspiration to engage with the course readings, and assistance with overall learning and exam preparation (see also Thalluri, Wache & Hiscock 2006 and Thalluri 2007). Students commented:

“Great form of independent study where I could see areas I needed to work on without having access to a lecturer.”

“Excellent for instant feedback and identifies areas that need improvement.”

“They cover points that I had not thought to read about. By taking the quizzes I have improved my knowledge on subjects.”

“Very good complement to the readings.”

The evaluation of virtual classroom revealed that this ICT was workable for the purpose of the mental health course considering the desirable comments gathered. Results showed that learning was enhanced and that the environment created was conducive to learning, understanding, feeling of belonging and enjoyment of the course. The comments from students on the table throw further light on the benefits derived from this ICT. One problem identified however was scheduling the virtual classes to fit the students’ itinerary as many were gainfully employed while studying.

The findings from the Facebook evaluation showed that the manner in which Facebook was used for the course impacted positively for the majority of students. Exactly how it benefitted them related to their learning of the course content as Facebook provided students many opportunities for learning (100%). Facebook assisted students’ learning about the topics (90%), helped them direct their own learning (80%), and enhanced understanding of disease processes (80%). Most students maintained that it was an innovative (100%) and effective (80%) way to learn. It increased students’ interest in the subject (100%), resulting in their being well engaged with the course content (80%).

The most important impact of Facebook was the opportunities it provided for greater interaction with the lecturer (100%), learning with/from peers (100% and 90%), and working with others (100%). Students reported:

“More contact with peers and lecturer with flexible hours.”

“Gives students the opportunity to learn from each other and discuss uni related issues.”

“Instant feedback on all questions about the course or other subjects from Joy and peers.”

“Closer relationship with lecturer, I felt more at ease and could ask questions any time which helped my learning.”

9. Issues and concerns

While there may be many benefits derived from using these technologies, there are also several issues and concerns in their use. Many students are limited by their ability to access the technology, while others do not
possess the required technical skills nor devote adequate time and effort for e-learning (Santy & Smith 2007). For e-learning to be beneficial, students need to be active learners; they need to be consistent, disciplined, and organised also. Furthermore, while e-learning enhanced by various ICT applications provides a stimulating learning environment, it requires students to be self-directed and motivated in their studies.

In our evaluation, some students had misgivings about the virtual classroom because they were not able to join classes and because they could not access virtual classroom recordings. This tells us that the use of ICTs must be carefully and strategically planned and implemented taking into consideration the availability of students. Setting up the relevant questions for the online assessments was challenging and time consuming. Staff members involved were overwhelmed with emails from students requesting information about how to access these resources and assessments. Though adequately introduced and designed, a concern about Facebook was the need “to clarify more fully the use of Facebook to enhance the communications between students to ensure their understanding and progress”. In addition, Facebook was not a good substitute for classroom according to students.

Moreover, ICT is not necessarily a panacea for improving the quality of teaching and learning; it is important that academics continually evaluate each innovation and appraise their changing practices. The ‘high tech’ of technological resources and the ‘high touch’ of human responses to them, to use Naisbitt’s terms (Naisbitt 1982), are aspects of learning that academics must strive to achieve. Good technology does not compensate for poor teaching practices (Penman & Ellis 2008). According to Naisbitt, the ‘high tech’ of technological innovations does not do away with the need for the human aspect – the ‘high touch’. In our study, a student observed online assessments negatively stating that: “... the nature of the assessment was that there was no face-to-face contact with students nor lecturers.”

The more advanced the technology, the greater the need for supplementing it with the real or virtual presence of keen, caring teachers, along with supportive colleagues, if its benefits are to be maximised. Being aware of this need for ‘high touch’, future evaluations need to include items that implicitly gauge the success of ICT integration in course delivery.

10. Conclusion

The Thalluri-Penman model provides a structured set of innovative learning initiatives for commencing and continuing health science undergraduates. The conceptual model has significantly contributed to individual student success and positive learning experience at UniSA. It is an evolved approach which reflects the accumulated wisdom and experience of both of these university teachers and addresses contemporary and best practice teaching and learning requirements for diverse student cohorts.

ICT is embedded in the model and the various initiatives implemented have positively impacted on students’ experience and performance in studying sciences. From our study, the use of technology that is carefully considered in each stage of the program has been shown to enhance the quality of university teaching and learning, allowing greater accessibility, flexibility and interaction. ICT is beneficial in terms of providing an interesting, rewarding, exciting and effective way of learning and teaching; fostering greater interaction and collaboration amongst students and staff; and effectively engaging diverse student cohorts and minimising student disengagement. However, it is imperative also that academics consider these information and communications technology and electronic learning with caution because of some issues and concerns they raise. They need to carefully and strategically plan their ICT applications and continually evaluate the same.

References


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Implementing Blended Learning at a Developing University: Obstacles in the way

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Abstract: Higher Education Institutions (HEIs) are striving to provide effective learning experiences to address the needs of the digitally-oriented generation of learners. Blended learning has emerged as a solution to address these needs and has been adopted by various HEIs. However, not all academic staff members adopt blended learning when it is introduced by their institutions. Although this teaching and learning approach offers various advantages to academic staff, negative perceptions held by academic staff may affect its adoption. The purpose of this case study was to investigate the perceptions academic staff have about blended learning and to identify challenges facing academic staff that affected the adoption of blended learning in a Faculty of Education at a developing university in South Africa. The study employed the Technology Acceptance Model (TAM) developed by Davis (1993) and the Innovation Diffusion Theory (IDT) by Rogers (1983: 246-250) in a qualitative exploratory research design. The investigation made use of focus group interviews with lecturers and individual interviews with heads of academic departments, as well as the dean of the Faculty. Data gathered pointed to various perceptions and practical problems hindering academic staff from adopting blended learning. Amongst these were perceptions pertaining to e-learning or blended learning policy, faculty support by management, computer skills of students and lecturers, as well as inadequate access for students to computers. This research is unique in that it applies known knowledge in the new context of a small South African university, which is a developing community. Lessons learned from this study will make a contribution to knowledge in the field of higher education, and will help developing universities to benefit from the research.

Keywords: blended learning, adoption, academic staff, perceptions, challenges, developing university

1. Introduction

Higher Education Institutions (HEIs) are striving to provide effective, flexible, convenient and accessible learning experiences to address the needs of a new generation of students entering these institutions (Thomas, 2008). This generation of students has a keen interest in using technology and demand to use technology in teaching and learning, in and out of the classroom (De George-Walker and Keeffe, 2010). These students display technology-influenced aptitude, attitudes, beliefs and sensitivities (Oblinger, 2003). They define technology broadly, beyond the computer and the internet, to include the ability to adapt technology to meet individual needs (Roberts, 2005). They thus challenge academic staff members to utilise innovation in their delivery approaches. This has led to various institutions adopting blended learning as one of the approaches used for teaching and learning (De George-Walker and Keeffe, 2010; Dziuban, Moskal and Hartman, 2005). The blended learning approach also offers several advantages to academic staff, such as accessibility of information, universal connectivity, which enables the formation of communities of inquiry, and innovative teaching strategies. However, negative perceptions held by members of academic staff could affect the adoption of blended learning (Davis, 1993; Thomas, 2008; Oh and Park, 2009; Fresen, 2010). Such perceptions relate to attitudes towards innovation and change, time required for implementation, workload, level of institutional support, available technology infrastructure, instructional delivery methods and quality assurance. Using the Technology Acceptance Model (TAM) (Davis, 1993), the researchers explored the
perceptions of academic staff towards the adoption of blended learning in the Faculty of Education at a developing university in South Africa, herein referred to as University A. The TAM was selected because it is robust and useful for determining how work-related information technology (IT) innovations are adopted by employees for their work (Liu, Li, and Carlsson, 2010).

University A is a comprehensive traditional university offering approximately 252 accredited degree, diploma and certificate courses across its Faculties of Arts; Education; Science and Agriculture; and Commerce. It is situated in a rural setting that, although part of the global village, is not highly influenced by technology (University A, 2013). The University’s student population is 16,118, comprising 14,819 undergraduates and 1,299 postgraduate students. It draws the majority of its students from southern African countries but also attracts students from Asia, South America and Australasia. With regard to the use of technology in course delivery, an E-learning Implementation Strategy and Plan was approved by the University’s senate in 2009 (University A, 2009: 4). This plan identified the following challenges hindering the implementation of e-learning:

- The University lacks comprehensive institutional and organisational mechanisms for facilitating the development and growth of e-learning;
- Lack of a policy that promotes e-learning within teaching and learning;
- Lack of quality management processes to enhance e-learning;
- Limited initiatives for the professional development of staff to integrate e-learning within existing curricula;
- No structures in place for technical and system support;
- Lack of support from leadership for change management; and
- Considerable funding is needed to implement a successful e-learning programme.

University A acquired the learning management system (LMS) Moodle as part of the e-learning implementation plan. However, academic staff members hold the perception that it takes time and effort to develop e-learning activities and, subsequently, they are reluctant to use Moodle (University A, 2009). It is against this background that the research study on which this article is based was conducted.

2. Aim of the study and the research question

The aim of the research study was to explore the perceptions of and to identify challenges facing academic staff that affected the adoption of blended learning in the Faculty of Education at a developing university in South Africa. The study addressed the following research question: What are the academic staff perceptions that affect the adoption of blended learning in the Faculty of Education at University A?

3. Literature review

The concept of blended learning is derived from two words, blend and learning. The word blend means combining things and learning denotes an assimilation of new knowledge as explained by Olivier (2011). Blended learning allows students to engage in learning outside the confines of the classroom; with synchronous tools, such as web conferencing, Skype and group chats, and asynchronous tools that include discussion boards, blogs and social networking sites (Singh, 2003). There is no single commonly accepted definition of blended learning, but practitioners “negotiate their own meaning” according to the needs of their contexts of practice (Heinze, 2008: 8). The absence of a universal definition for blended learning allows HEIs to contextualise the concept according to their respective environments. Hence, this study adopted the definition of blended learning used by the university involved in the case study concerned, which is, “the mixture of traditional delivery including: lectures, group discussions, apprenticeships and experiential learning, together
with e-learning methods, which accommodate various learning needs of a diverse audience in a variety of subjects” (University A, 2009: 1. There are, however, opposing views about delineating the concept of blended learning. For instance, Oliver and Trigwell (2005) caution against the use of the term blended learning primarily because it does not incorporate the perspective of the learner, and because it considers blending from a lecturer’s point of view. Another common objection to blending, cited by Jackson (2011), is that aiming for a coherent blend of learning provided through a variety of delivery mediums and instructional techniques is hard—he reckons that it will take some careful thought and planning to achieve this. Moreover, only a handful of learners fully engage with all the elements of blended learning, so it is not worth the effort (Jackson 2011).

Despite the various and sometimes contradictory definitions of blended learning and the different challenges involved in implementing blended learning, HEIs are striving to adopt blended learning because of the potential it has for transforming higher education and engaging students in more meaningful learning experiences (Garrison and Kanuka, 2004). Blended learning is also recognised as a useful approach for improving pedagogical practice (Kenney and Newcombe, 2011).

The advancement of technological innovation in HEIs has necessitated the formulation of new policies, strategies and improvements in infrastructure. Despite all these supporting enterprises instituted by HEIs, the adoption of blended learning depends, in part, on the perceptions an academic staff member has about the use of technology in teaching and learning. Oh and Park (2009), Alebaikan (2010) and Fresen (2010) concur that perceptions held by academic staff can have an impact on the adoption and success of blended learning within institutions. From the literature reviewed, we concluded that some of the barriers to the adoption of blended learning by academic staff are their own adequate or inadequate computer skills, lack of time to prepare new and appropriate teaching and learning materials, students’ restricted access to technological resources and, among academic staff members, a lack of innovative teaching strategies to address the digital generation of students (Benson, Anderson and Ooms, 2011; Brown, 2002; Gutteridge 2009; Ocak, 2010; Prinsloo and Van Rooyen, 2007; Thomas, 2008). Fresen (2010) points out that most academic staff members use technology for inter alia, research, academic writing and communication, but few use it for teaching. She concludes that successful technology adoption, therefore, depends on the perception of an individual academic staff member.

For a better understanding of barriers to and perceptions about the adoption of blended learning, the Technology Acceptance Model (TAM) (Davis, 1993) was employed to explore the perceptions of academic staff that affect the adoption of blended learning in the Faculty of Education at University A. Additionally, the Innovation Diffusion Theory (IDT) (Rogers, 1983) was utilised to categorise academic staff members according to their rate of blended learning adoption.

3.1 Technology Acceptance Model (TAM)

The TAM was developed by Davis (1993) to explain the acceptance of a technology. Although blended learning is not a technology per se, technology forms an integral part of this teaching and learning approach. This study utilised the TAM for its investigation because it was deemed an appropriate tool for enabling the researchers to determine the factors that influence academic staff in their acceptance of a technology (blended learning) that was new to them (Almobarraz, 2007). The TAM has continually been found to be useful, as many researchers, such as Ifinedo (2006), Wahid (2007), Van der Linde (2009), Chuttur (2009), Liu, Li and Carlsson (2010) and Liu, Chen, Sun, Wible and Kuo (2010), use it. The aspects of the TAM are illustrated in Figure 1.

According to Davis (1993), the receptiveness of an individual to accepting and adopting technology can be divided into two distinct categories, namely, the perceived ease of use (PEOU) and the perceived usefulness (PU) of the technology. Although each of these two categories can influence someone’s attitude towards using technology separately, they are also interrelated and the PEOU of technology can directly affect the PU, and vice versa. The PEOU and the PU of technology are also influenced by external factors (Davis, 1993) and the
external factors in turn influence the attitude towards using technology, thereby leading to the actual use of technology or the decision not to use technology. External factors include system features, situational constraints, user characteristics (Vishwanath and Goldhaber, 2003) and organisational job category, such as staff’s support (Hubona and Geitz, 1997).

Figure 1: Technology acceptance model (Adapted from Davis, 1993:476)

3.2 Innovation Diffusion Theory (IDT)

Another theory that was used in this study, along with the TAM, to enhance the understanding of the adoption of technology innovation by members of academic staff in their teaching, is the IDT (Rogers, Singhal and Quinlan, 1999). The researchers chose the IDT as an instrument to explore the rate at which academic staff in the Faculty of Education adopted blended learning (Thomas, 2008). It has been established that the TAM and the IDT complement each other in explaining the acceptance or rejection of technology (Almobarraz, 2007). Rogers (1983) proposes that individuals are categorised according to the rate at which they adopt innovation, as shown in Table 1.

Table 1: Innovation adoption categories

<table>
<thead>
<tr>
<th>Category</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Innovators (2.5%)</td>
<td>Risk takers who take the initiative to try something new</td>
</tr>
<tr>
<td>Early Adopters (13.5%)</td>
<td>Respected group leaders who encourage adoption by the whole group</td>
</tr>
<tr>
<td>Early majority (34%)</td>
<td>Careful and unwilling to take risks</td>
</tr>
<tr>
<td>Late Majority (34%)</td>
<td>Always suspicious of or resistant to change and are difficult to influence</td>
</tr>
<tr>
<td>Laggards (16%)</td>
<td>Adamant in resisting change</td>
</tr>
</tbody>
</table>

Adapted from Rogers (1983:246)

The preceding section provides information regarding the adoption of technology or innovation by means of the TAM and the IDT. In this research study the two theories were applied to blended learning, an innovation in a teaching and learning context. The models informed and guided the research design and methodology of the research study.
4. Research design and methodology

In addressing the research question, a qualitative exploratory case study research design (McMillan and Schumacher, 2010) was employed. The use of this design was grounded within the interpretivist epistemology in an effort to understand the perceptions of the academic staff regarding the adoption of blended learning, through the meanings and importance that these academics assigned to it (Maree, 2010).

The study used a purposive and complete sample wherein the entire population of 41 academic staff members in the Faculty of Education were invited to participate in the study (Cohen, Manion and Morrison, 2010). In the end 25 academic staff members participated in the research study; 16 lecturers participated in a survey and in focus group interviews, while all eight heads of departments and the dean took part in individual interviews.

Data were collected separately from each of the three professional levels of the Faculty, in order to give freedom of expression to lower-level members. A one-to-one informal conversation interview (McMillan and Schumacher, 2006) strategy was employed with the dean of the Faculty. Semi-structured interviews were conducted with each head of department (HOD) while lecturers participated in semi-structured focus group interviews. Lecturers also responded to a questionnaire that was designed to elicit information on selected characteristics of the lecturers who participated in the study.

5. Findings

The questionnaire provided the study with pertinent data regarding selected characteristics of the 16 lecturers who participated. Six of the interviewees were female and 10 were male. The majority (12) of the participants were lecturers. Three were junior lecturers and only one was a senior lecturer. Most (12) of the participants were mature and aged between 31 and 50 years of age. Of the 16 participants 11 reported that they had been teaching at university level for a period of three to six years; two participants had been teaching for seven to 10 years and two for more than 10 years. In their self-rating of computer literacy skills, 14 academic staff members indicated that they had adequate computer literacy skills that met the requirements for implementing blended learning. Two junior lecturers who had taught at university for less than two years indicated that they had less than adequate computer skills. In the group, only two lecturers reported that they had used Moodle or another LMS for a period of three to five years and another two admitted having used an LMS but for less than two years. The remaining 12 had never used an LMS. In addition, only two lecturers reported teaching modules that were currently using Moodle. These two lecturers reported that they had posted learning and assessment activities and discussion forums on Moodle of their own volition, hence they may be categorised as innovators according to Table 1 (Rogers, 1983). They took the risk of being trailblazers in using Moodle at University A. It is important to note that only one HOD reported teaching a course through Moodle.

The IDT was employed to categorise the academic staff in the faculty according to the rate of adoption of blended learning. The study identified and classified the three participants who indicated that they were using blended learning in their courses as innovators. Based on the innovation adoption categories described by Rogers (1983), there were no other clear categories. Hence, the conclusion is that there is a blended learning adoption gap between the three participants and the other 22 academic staff participants. Therefore, it can be deduced that, according to the IDT, there were only three innovators; no other categories had emerged over the 5-year period since the introduction of Moodle at University A. Despite the continued use of computers in research and in communication, participants seemed to be slow adopters of blended learning, a behaviour that had also been observed by Fresen (2010) with regards to the acceptance of computer technology for learning.

The discussion that follows is informed by the themes and interview responses relating to the TAM, as summarised in Table 2. The table provides the summaries of interview discussions as responses according to
the predetermined themes and interview questions based on the TAM. These responses have been organised to form sub-themes.

**Table 2: Themes, related interview questions and responses**

<table>
<thead>
<tr>
<th>Theme</th>
<th>Interview question</th>
<th>Response/Sub-theme</th>
</tr>
</thead>
</table>
| Understanding of Blended Learning (UOBL)  | 1. What is your understanding of blended learning?                                  | • Never heard of blended learning  
• Mixed teaching methods  
• Use of computers in teaching and learning |
| External Factors (EF)                      | 2. Do you think your level of technology knowledge is sufficient for teaching a blended course? Why or why not? (Lecturers) | • Inadequate technology knowledge, need training  
• Adequate, holding an ICDL (International Computing Driving Licence) |
|                                            | 3. How has the introduction and implementation of blended learning in the Faculty of Education influenced your decision to engage or not to engage in blended learning? | • Not influenced, using blended learning out of personal interest  
• Not realised any implementation  
• Discouraged by inadequate technological resources |
|                                            | 4. Do you think that the Faculty of Education has an enabling structure for the implementation of blended learning? Why or why not? | • No blended learning structure in place  
• No guiding policy for blended learning implementation |
| Perceived Usefulness (PU)                  | 5. What do you perceive to be the benefits of using blended learning in higher education? | • Time saving and benefiting large classes—reaching a large group in a short time  
• Easy access to electronic resources  
• Flexibility—accessibility of learning resources at all times  
• Promoting student independence  
• Creating opportunities for networking |
| Perceived Ease of Use (PEOU)               | 6. What is your perceived level of difficulty of using blended learning?             | • Uncertain  
• Difficult without support  
• Not doable |
| Attitude Towards Using Blended Learning (ATUBL) | 7. Are you currently using blended learning as a teaching mode? Why or why not?       | • Not using blended learning due to a lack of knowledge  
• No, students have very limited access to computers  
• Yes, out of personal interest |
|                                            | 8a. What are your views on the barriers that impede lecturers from engaging in blended learning? | • Lack of a policy on blended learning  
• Large class size  
• Computer illiteracy of students and lecturers  
• Inadequate technological resources  
• Lack of institutional support |
|                                            | 8b. What are your recommendations for the introduction or improvement of the implementation of blended learning in the Faculty of Education? (HODs and Dean) | • Incorporate blended learning into the curriculum  
• Provide e-learning infrastructure in the Faculty  
• Develop e-learning skills of staff and students  
• Monitor and evaluate the implementation of blended learning |
This table provides evidence that the academic staff had a variety of opinions regarding the adoption of blended learning in their faculty.

6. Discussion
In addressing the research question, five themes and their respective sub-themes were identified with regard to various perceptions that academics had towards the adoption of blended learning. Some lecturers and HODs displayed little or no understanding of the concept of blended learning, to the extent that the interviewing researcher had to describe blended learning to the interviewees in order to ensure that everyone had a common understanding of the concept. The researcher deemed it essential that academic staff display a contextually correct understanding of the concept of blended learning in order to perform related duties accordingly.

Even though most of the participants reported that they used computers for some activities, such as research and in-class face-to-face presentations, they perceived that they could not adopt blended learning because of the lack of an enabling environment. External factors mentioned as contributing to the environment included the absence of policy on blended learning; inadequate training for staff; and limited access to the computer laboratory for students. These factors were perceived as constraining the implementation of blended learning. In this study it became apparent that the external factors indirectly influenced the participants’ decisions not to use blended learning. Even the staff members who indicated that they were comfortable using computers did not have the confidence to engage in blended learning due to a lack of adequate knowledge of blended learning; hence they recommended staff training.

The challenges relating to blended learning implementation clearly centred around the absence of a policy on blended learning. The absence of a unit to promote the implementation of blended learning also posed a serious challenge, hence the uncoordinated implementation of blended learning by a few lecturers. Other factors mentioned as contributing to non-adoption of blended learning include inadequate computer equipment, large classes and lack of staff training to integrate online learning and face-to-face learning. In addition, poor means of disseminating information in the Faculty of Education further reduced the chances of lecturers implementing blended learning. Thus, some academic staff members were unaware that blended learning was being practised by their colleagues. All this information confirmed that the Faculty of Education lacked an enabling structure for the implementation of blended learning in terms of infrastructure, policy and support.

With regard to perceived usefulness, all the participants indicated that they realised the potential benefits of blended learning, ranging from flexibility to accessibility of learning. However, the perception that blended learning required effort raised fear of failure in some participants while others literally admitted that they suffered from technophobia. The fear that blended learning might introduce digitalisation in the Faculty aroused fears of becoming redundant. Lack of confidence seemed to dampen the spirits of the lecturers, who perceived themselves as having basic computer skills but not the necessary expertise to use blended learning. They conceded that they would need extensive staff development in order to implement blended learning.

A few positive perceptions about the perceived ease of use, such as the following, were noted:

- I have been using a computer for more than 10 years and blended learning will not be a problem for me.
- I think my advantage is that I hold an ICDL and can easily manoeuvre the system. I do everything online, like keeping class register, tests, assignments and discussions.

Negative attitudes towards using blended learning were revealed by statements such as:
My problem is being an IT dwarf ... My [computer knowledge] level is not sufficient. I need to be upgraded.

Fear of learning what is new. I wonder if at this age I still want to try new things and fail.

We are not all technologically intelligent. Some people think there is complexity and complications in these computer-related gadgets.

Personally, due to ignorance, I am not a technology person; I am somehow a traditionalist.

Some participants reported basic problems that hindered the adoption of blended learning in the Faculty of Education at University A:

The idea is there in the Faculty, but the challenge is a lack of resources.

I have never seen or heard about policy on blended learning in the Faculty.

Thus, it can be deduced that the members of academic staff faced obstacles in adopting blended learning. In summary, serious challenges that hindered the adoption of blended learning were perceived to include the following aspects:

- Lack of policy–Policy is critical for providing the guiding principles for implementation;
- Lack of faculty support–To ensure effective implementation of a newly introduced approach;
- Lack of technological and computer skills–These skills are essential for the use of blended learning by both students and academic staff;
- Large class size–Considering the limited computer-related resources available, it seems a daunting task to introduce blended learning; and
- Inadequate technological resources–The lack of adequate computers for use by students makes the proper practice of blended learning elusive.

Consequently, academic staff members were unanimous in advocating for the establishment of a policy on blended learning, upgrading of computer laboratories for students and the establishment of a unit to coordinate blended learning and all related activities. Most of the participants were keen to develop their own skills related to the implementation of blended learning through staff development workshops. One recommendation articulated by most participants was that all academic staff members should undergo training in the use of Moodle. They expressed a deep desire for the faculty to set processes in motion for the implementation of blended learning.

7. Conclusion

Despite the good intentions of University A to introduce blended learning by acquiring Moodle, the Faculty of Education staff were not utilising the facility that could have been instrumental in the use of blended learning. Findings indicate that this was a result of a failure to plan properly for the implementation, monitoring and evaluation of blended learning. Furthermore, it seems that the LMS (Moodle) is not assisting students, who are supposed to be the primary beneficiaries, probably due to uncoordinated efforts to implement blended learning in the Faculty of Education.

As a way forward, it seems clear that new injections of creative innovation and active management of teaching and learning programmes are necessary at University A. Since computer-related resources were found to be inadequate, a fresh look at other technologies, such as mobile phone technologies, might open avenues for promoting blended learning. The use of mobile phones in blended learning is recommended because South Africa, for instance, has mobile phone coverage of 100.48% (some users have multiple subscriptions) (Beger and Sinha, 2012). Adolescents and young people have been identified as the first adopters of mobile
technology, with 72 per cent of 15 to 24-year-olds reported as “having a cell phone” in a national survey in 2007 conducted by The Kaiser Family Foundation and the South African Broadcasting Corporation (Beger and Sinha, 2012: 11-12). This percentage is believed to have increased over the years. Students’ use of mobile phones for learning would enhance face-to-face tuition, improve learning, stimulate learning and improve student engagement. In addition, strong leadership at middle managerial level is required to ensure that a blended learning policy is in place, implementation is monitored and adequate digital and pedagogical support is available to staff and students.

Moreover, the preceding findings and discussions indicate a need for further research on the formulation of guidelines for implementing blended learning at the Faculty of Education. For further research, a thorough analysis and evaluation of aspects hindering adoption is needed. This should also include an investigation among students. This case study could also be extended to other faculties, although lecturers in education are expected to be the frontrunners in teaching and learning practices.

Although this study might have covered known knowledge at some levels of research in higher education, it is unique in the sense that it applied known knowledge in a new context, that of a South African developing university in a rural community. Therefore, it is hoped that the research findings will make a contribution to the implementation of blended learning in newly established universities.

References


"I am not a Person with a Creative Mind": Facilitating Creativity in the Undergraduate Curriculum Through a Design-Based Research Approach

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Abstract: Today's graduates need the skills to enable them to 'persevere in the face of complexity and unresolvability' (McWilliam and Haukka 2008: 660), and to respond creatively in work environments that are increasingly dependent on digital technologies (Cunningham 2006). However, although many higher education institutions (HEIs) acknowledge the importance of creativity within the curriculum (McWilliam 2007a), it is argued that universities are failing to equip graduates with the creative skills they require to be effective in the workplace. Design-based learning (also referred to as learning by design) is ideally suited to facilitating the development of creative problem solving (CPS) skills by engaging students in complex learning activities involving the active construction of knowledge through a series of iterative cycles of experimentation and refinement of concepts (Naidu 2004). Similarly, design-based research (DBR) involves a series of iterative steps to design and develop learning environments and theories the design, while also informing the development of practical guidelines (Reeves, Herrington and Oliver, 2005). This paper reports on findings from a project funded by the Australian Government Office for Learning and Teaching, which aimed to develop a CPS framework and supporting online system to scaffold teachers and students through a creative problem solving approach founded on the principles of DBR. The study employed a mixed-methods DBR approach involving multiple iterations to design, develop, trial and implement the framework and tool, as well as the development of principles and practical guidelines for application in the classroom. The findings reported in this paper focus on the DBR process and the experience trialling the CPS tool in a first-year undergraduate course offered in the School of Communication, International Studies and Languages at the University of South Australia. The paper reports on the implications of the findings from the project and the benefits of DBR as a methodology informing the design, development and implementation of a technology enhanced learning approach to fostering CPS in the undergraduate curriculum.

Keywords: Creativity; Creative Problem Solving; Design-Based Research; Higher Education; Graduate Attributes; Generic Skills

1. Background

The need for a more creative workforce able to respond to complex and uncertain times is well established (Craft 2006; Florida 2003; McWilliam 2007a; Pink 2006). Creativity and innovation are crucial to the success of businesses in the networked information society of the 21st Century, necessitating graduates who are able to undertake creative work in environments that are increasingly dependent on digital technologies (Cunningham 2006). Recognition of the changing demands in a knowledge based economy and the need to better prepare graduates with 21st century skills (Transforming Australia’s Higher Education System 2009) has refocused attention on the need for universities to foster the development of graduates’ employability skills such as the ability to communicate effectively, solve problems, work in teams and think creatively. This emphasis is also evident in the Australian Government’s HEI funding strategy, with its focus on the employability of graduates and the production of graduates who are ‘work ready’ (Harvey & Shahjahan 2013).

The Australian Government has also highlighted the central role that creativity plays as the driver of social and economic success. In a report arising from the Australia 2020 Summit held in 2008, ‘creativity, interpretation, innovation and cultural understanding’ are identified as core skills required by the industries of the 21st century (Responding to the Australia 2020 Summit 2009: 193). Yet despite this recognition of the central role of creativity and innovation in the workplace, many argue that universities are failing to equip their graduates with these skills (Craft 2006; Tosey 2006). Moreover, although creativity, creative thinking and innovation are generic skills required for life-long learning, as with many other generic skills identified by employers, these skills do not feature in any Australian graduate attributes statements (Oliver 2011). Although HEIs acknowledge the importance of creativity within the curriculum (McWilliam 2007b), many programs focus on particular kinds of graduate attributes and traditional educational approaches, rather than employability skills.
relating to creative thinking and creative problem solving (Gluth and Corso 2009; Wood et. al. 2011; Wood et. al. in press). There are also many pressures on teachers in HEIs, where there in an intolerance to ambiguity, lack of time and space for experimentation, fear of making mistakes, high levels of stress, and the lack of a sense of challenge (Byron 2007), which contribute further to their resistance to embedding creativity in the curriculum. Emphasis in education has been mostly concerned with what De Bono (1973) calls vertical thinking; the process of proving and developing concept patterns, whereas lateral or creative thinking sets out to restructure such patterns and provoke new ones.

One of the major barriers facing teachers wishing to incorporate creative approaches in their teaching and learning has been the lack of explicit guidelines and a scaffold to guide them in making the required shift from outmoded teaching approaches to more innovative approaches to embedding creativity within the curriculum. This is especially so in discipline areas outside of design and the arts (Gluth and Corso, 2009). Tosey (2006: 35) suggests that creativity in the higher education curriculum is more often used ‘to converge and control’ than to engage productively ‘at the edge of order’ (Fullan, cited in Tosey 2006: 34). To change this prevailing culture, argues Jackson (2006), we need to change our approach from penalising mistakes to one of appreciating that making ‘mistakes’ provides important lessons for learning. ‘By perceiving ‘mistakes' as opportunities for, and proof of, learning instead of failure, we begin to change the paradigm to one that is more enabling and valuing of creative effort’ (Jackson 2006: 197).

Another potential reason that universities have failed to embrace creativity in the curriculum more widely across different disciplinary fields is the lack of a concise definition of creativity within policy documentation (McWilliam 2007a). Edwards (2000) suggests that the term ‘creativity’ has an amorphous nature; a gift that is only possessed by an exceptional few. However, research has drawn attention to the importance of fostering the creativity of all learners (Csikszentmihalyi 1982; McWilliam 2007a). Researchers are also challenging the assumption that creativity is purely an innate capacity and cannot be learned (McWilliam 2007a; Robinson 2001), and they have demonstrated that human intelligence is complex and multifaceted (Robinson, 2001). Creativity is enhanced by other capacities and learner motivations and also influenced by the cultural context; cultural conditions can kindle or kill creativity (Robinson, 2001).

A third barrier to changing the educational paradigm in ways that foster the creative capacities of future graduates relates to the lack of strategies to help teachers develop the skills to engage with creativity ‘intentionally as an outcome of pedagogical work’ (McWilliam 2007a: 4). Fostering creativity is ‘best achieved through a process-based or activity-based curriculum that engages students in challenging, novel and unpredictable ways of working and learning’ (Jackson 2003 cited in Jackson 2006: 213), however, the strategies for achieving this goal are less evident for teachers. The following sections outline an approach aimed at addressing these three barriers through the design and development of a CPS framework and associated tools to provide a scaffold to teachers in the design of their curricula, and to guide students in applying the skills of creative problem solving in their studies.

2. A Systems Approach to Creativity

Creativity is the process of creating novel and useful ideas or products (Dewett 2003). Although creativity can be learned and assessed, the learning environment will either facilitate or impede the achievement of creative performance. A CPS framework needs to be able to be adapted to suit the domain and field of study, while also accommodating individual student needs by taking into consideration their abilities and preferred learning styles. Such a framework also needs to optimise the opportunities both divergent and convergent thinking, risk taking, evaluating decisions, and synthesising existing and new information in order to arrive at an optimal outcome. Finally, the framework should address strategies to maximise the conditions under which the experience of learning will be its own reward (referred to by Csikszentmihalyi (1996) as being in the ‘flow’).

Amabile (1996) identifies three components of creative performance: 1) domain-relevant skills; 2) creativity-relevant processes; and 3) task motivation. Such an approach is consistent with Csikszentmihalyi’s (1999) systems approach in recognising that domain-relevant skills (for example, facts, principles, technical skills, and opinions) are required for a student to be able to assess the range of response possibilities and to be able to synthesise the information against which the new response is to be judged (Csikszentmihalyi 1999; Dewett 2003). Creativity-relevant processes determine the degree to which a student’s response will surpass previous
responses in the domain (Dewett 2003), while task motivation refers to the student’s attitude and motivations for undertaking the task, as well as his/her understanding about why the task is being engaged (Amabile 1996; Dewett 2003). Again, consistent with (Csikszentmihalyi 1991), Amabile agrees that creativity is more likely to be facilitated when the task is intrinsically motivating (the experience of learning is its own reward) (Csikszentmihalyi 1991).

The principles of CPS have been attributed to the pioneering work of Alex Osborn who developed the approach as an aid to the understanding the different phases of creative problem-solving (Isaksen and Dorval 1993). The Osborn-Parnes CPS model is a modification of Osborn's CPS approach, comprising three major stages: 1) exploring the challenge; 2) generating ideas; and 3) preparing for action, and six steps within those stages: 1) objective finding; 2) fact finding; 3) problem finding; 4) generating ideas; 5) solution finding; and 6) acceptance finding (Creative Education Foundation 2010). This model is depicted as a cycle, recognising the need for flexibility and that creativity tends to function in a more cyclical than linear pattern. Variations of the model have been used across a range of disciplinary fields and for various purposes including the development of educational materials (Torrance 1978), to facilitate inclusive education (Giangreco et al. 1994), and as a framework to support the marketing curriculum (Titus 2000). Amabile’s (1996) componential framework of creativity incorporates a similar CPS approach, but in this approach, the components of the creative performance (domain-relevant skills, creativity-relevant processes and task motivation) that impact on the individual’s creative performance are also considered. All CPS approaches acknowledge the iterative nature of the problem solving process and the need for both divergent thinking (particularly during the early stages of the cycle) and convergent thinking as ideas are further refined.

### 3. Design-based research (DBR) approach

Design-based research emerged as a methodological approach in the 1990s (Brown 1992; Collins 1992) in response to the need for educational research that produces 'new theories, artifacts, and practices that account for and potentially impact learning and teaching in naturalistic settings' (Barab and Squire 2004: 3). DBR addresses complex problems in real contexts, builds on theory and design principles to implement technology enhanced innovations to address the identified complex problems and involves reflective inquiry in the process of designing, trialling and implementing innovative learning environments. DBR differs from action research in that DBR should result in the creation of new design principles and practical guidelines for teachers (Anderson and Shattuck 2012; Barab and Squire, 2004; Reeves, Herrington and Oliver 2005). The Design-Based Research Collective (2003) identifies five characteristics of DBR:

- The process of designing learning environments and developing theories are central to the approach.
- The research process involves continuous iterative cycles of design, enactment, analysis, and redesign.
- The research leads to theories that are of relevance to teachers and educational designers.
- The research is undertaken in 'authentic; settings and documents the successes, failures and interactions in the local context to better understand the implications for applying in other contexts.
- The methods connect processes of enactment to outcomes.

DBR was chosen as the research approach for the study reported in this paper, and in keeping with the characteristics of DBR, our research team comprised teachers, researchers and designers working in collaboration and the research approach employed mix-methods with multiple iterations involving designing, developing, trialling, evaluating, reflecting and redesigning informed by the previous iteration.

#### 3.1 Research method

The project commenced in October 2011 and is on-going. The initial project aims were to design and develop a CPS framework ([http://www.creativity-project.net/cpsframework.php](http://www.creativity-project.net/cpsframework.php)) and open source online CPS tools to act as a scaffold for teachers in the development and redevelopment of courses ([Ingenium Teacher’s Tool](http://www.creativity-project.net/cpsframework.php)) and a CPS tool for students ([Ingenium Student’s Tool](http://www.creativity-project.net/cpsframework.php)) to guide them through the creative problem solving process in their coursework. The project also aimed to develop guidelines, case studies of the use of CPS in courses across a range of disciplinary fields and a suite of resources available via the project site.

The research approach involved six major stages reported in the following sections. While the CPS tools were trialled in ten courses, this paper reports the findings from only one of the courses; an undergraduate course, *Introduction to Digital Media*, undertaken by students enrolled in various undergraduate programs in the...
School of Communication, International Studies and Languages at the University of South Australia. The findings of the trials of the CPS tools in all ten courses are documented in full in the final report (Wood et al, in press). Details of each of the stages undertaken are presented in the following sections.

3.1.1 The design of a CPS model

The first stage of the research involved the design of the CPS model and framework informed by theories of creativity. The team drew on the seminal literature on creativity (Csikszentmihalyi 1982, 1991, 1996; Torrance 1978) and contemporary research such as Amabile’s (1996) componential framework of creativity and Titus’s (2000) CPS model in the design of the CPS framework and model. The adapted model developed for the study involves six stages (Figure 1), which correspond closely to the Titus (2000) model. However, in our adapted model we use the term ‘response generation’ rather than ‘idea generation’ for the fourth stage of the process because we view idea generation as fundamental to each stage of the creative problem solving process. Thus, idea generation is embedded in each stage of the process with alternating divergent and convergent ideation, shifting toward convergent thinking by the final stages of validation and completion/implementation (Brophy 1998). Our model also recognises the impact of the domain, field, and individual factors (Csikszentmihalyi 1999).

Figure 1: A Systems Approach to Creative Problem Solving (CPS) adapted from Amabile (1996), Csikszentmihalyi (1999) and Titus (2000)

3.1.2 The development of a CPS framework

The model developed during the first stage of the research process provided a conceptual overview of the processes involved in creative problem solving as well as the factors likely to impact on the way in which students engage with the approach. This model informed the development of a CPS framework incorporating the major stages of the creative process with associated practical techniques to guide teachers, and support students undertaking activities requiring them to apply the principles in practice. The techniques have been adapted from the idea generation techniques informed by the work of (Titus 2000), Gluth and Corso (2009) and The Global Creativity Corporation. The framework shown in Table 1 condenses the six stages identified in the CPS model into five major steps: 1) problem identification; 2) problem delineation; 3) information gathering; 4) experimentation and validation and implementation. Each stage in the CPS framework incorporates a list of techniques designed to assist students in generating ideas, classified according to whether the techniques involve visioning, modifying, exploring, or experimenting.
Table 1: A Framework for Creative Problem-Solving using Idea Generation Techniques adapted from Titus (2000), Gluth and Corso (2009) and Innovation Styles and Market Comparison (The Global Creativity Corporation)

<table>
<thead>
<tr>
<th>CPS Stages</th>
<th>Visioning</th>
<th>Modifying</th>
<th>Exploring/Discovering</th>
<th>Experimenting</th>
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</thead>
<tbody>
<tr>
<td>Problem Identification</td>
<td>Fluency of ideas involving generation of large number of possibilities</td>
<td>Refining what others have done using: SCAMPER technique: (s)ubstituting (c)ombining (a)dapting (m)odifying (p)ut to use (e)liminating (r)arranging</td>
<td>Cross referencing items either randomly or systematically demands new possibilities</td>
<td>Removing inhibitors increasing participants’ confidence to explore and try things when the outcomes are not always clear and they’re conditioned to having to come up with the single ‘right’ answer</td>
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<tr>
<td></td>
<td>Brainstorming</td>
<td>Modifying ideas based on peer feedback and discussion</td>
<td>Sensory Activity to facilitating exploring the problem and subsequent possible solutions</td>
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<td></td>
<td>Use of guided imagery</td>
<td>Using social media to create mash-ups of ideas</td>
<td>Using analogies and metaphors making associations that create more than the sum of two ideas</td>
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<td></td>
<td>Collaborating and discussing to generate ideas</td>
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<td></td>
<td>Using social media to enable community to submit their ideas</td>
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<tr>
<td></td>
<td>Using blog to reflect</td>
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<tr>
<td>Problem Delineation</td>
<td>Intuition to understand the bigger picture</td>
<td>SCAMPER – combining the deconstructed components in new ways</td>
<td>Using intuition as springboard for exploration</td>
<td>Assessing components to identify “leverage points” and opportunities for new approaches</td>
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<td></td>
<td>Refining the problem</td>
<td>Challenging assumptions to break patterns of behaviour and facilitating the unexpected</td>
<td>Refining ideas through discovery</td>
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<tr>
<td></td>
<td>Deconstructing the problem</td>
<td>Random Association to make connections between things even when they are not apparent</td>
<td>Using intuition to question assumptions and refine thinking about the problem</td>
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<tr>
<td></td>
<td>Mind mapping</td>
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<td></td>
<td>Storyboarding</td>
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<td></td>
<td>Using blog to refine thinking and reflect</td>
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<tr>
<td>Information Gathering</td>
<td>Seeking information on the big picture and component parts</td>
<td>Considering multiple sources and then looking for springboards</td>
<td>Challenging assumptions to generate new ways of addressing the research</td>
<td>Combining findings from sources to help refine the solution or to</td>
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<tr>
<td>Experimentation and Validation</td>
<td>Using visionary techniques employed to generate and identify problem to come up with novel solutions</td>
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<td>Using blog to document experiments and reflect on the outcomes</td>
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<td></td>
<td>Collaborating via blog and discussion forum</td>
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<tr>
<td>Implementation</td>
<td>'Produsage' using social media</td>
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<td></td>
<td>Discussion, peer review, use of web metrics and formal evaluation</td>
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<td></td>
<td>Personal blog for reflection on process</td>
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<td>Public blog for gaining feedback</td>
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<tr>
<th>Experimentation and Validation</th>
<th>Using blog to capture thoughts and document research findings</th>
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<tr>
<td></td>
<td>Sharing findings via wiki and bookmarking sites</td>
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<td></td>
<td>process</td>
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<td></td>
<td>Undertaking research using a variety of sources (Web, social media, library, databases, broadcast media, primary sources) and then refining research process</td>
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<td></td>
<td>Seeking different sources of information</td>
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<tr>
<th>Experimentation and Validation</th>
<th>Guided by intuition and refinement of the problem</th>
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<td></td>
<td>Using blog to capture thoughts and document research findings</td>
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<td></td>
<td>Sharing findings via wiki and bookmarking sites</td>
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<td></td>
<td>Modifying research strategy as ideas are refined</td>
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<td></td>
<td>Analysing information to identify priorities, possibilities and areas for further research</td>
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<td></td>
<td>Risk taking and making mistakes to explore possibilities without penalty if they don’t work, leading to refinement and weighing up the solutions to arrive at practical solutions</td>
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<td></td>
<td>Risk taking and making mistakes without penalty if they don’t work, leading to refinement and weighing up the solutions to arrive at practical solutions</td>
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<td></td>
<td>Building on the solutions that have been shown to be more likely to lead to success</td>
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<tbody>
<tr>
<td></td>
<td>Building on the solutions that have been shown to be more likely to lead to success</td>
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<tr>
<td></td>
<td>Exploring the unique contribution the innovation has made through market research and evaluation</td>
</tr>
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<td></td>
<td>Evaluating and examining success and identifying areas for future improvement.</td>
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</tbody>
</table>

3.1.3 Trials of the CPS framework in a first-year undergraduate course

Introduction to Digital Media (IDM) is a first year undergraduate course offered in the School of Communication, International Studies and Languages at the University of South Australia. The aim of the course is to introduce students to the principles of digital media through a practice-led research approach. Prior attempts at engaging students in research had proved challenging (see Wood 2010; Wood & Bilsborow, 2013 for detailed discussion of the results of formal evaluations).
The three assignments in the course build on each other and are designed to lead students through a practice-based research approach involving researching the needs of a not-for-profit organisation and producing pre-production documentation for a short promotional video clip for that organisation as the second assignment. Students then produce an associated website in which the promotional clip is embedded as their final assignment.

In the 2009 and 2010 offerings of the course students were asked to formulate their research using a paper-based version of the CPS framework designed to guide them through the idea generation process. A range of social media tools were utilised in the course: an 'ideas journal' students maintained as a personal blog throughout the course; a wiki to facilitate brainstorming and to encourage collaborative discussion; a discussion forum for peer review; a collaborative bookmarking site for sharing resources; and a YouTube channel, for showcasing student work to a broader audience.

Several emergent themes from the application of CPS in this course (see also Wood 2010; Wood and Bilsborow 2013) were noted based on teachers' informal feedback and student course evaluations conducted at the completion of each offering of the course:

- Teachers reported much greater creativity and divergence in the approaches students adopted in their digital media research assignments.
- Students reported greater confidence in their ability to generate ideas for their research projects.
- Several students noted that CPS was critical to the success of their research.
- Most students enjoyed the collaboration with their peers and noted that the use of peer review facilitated via the discussion forum helped them to improve on their work.
- One student suggested that 'I thoroughly enjoyed this topic as it was highly creative and we were given a high degree of creative freedom despite having to work within the limitations set down'.
- Another commented 'The creativity component challenged my technical ability' and another reflected on the link between research and creative thinking, 'It was more research based and required a lot of creative thinking'.
- Creativity and problem solving developed through practice-led research was a commonly recurring theme in most student comments as this student’s feedback indicates, 'Creative idea generation methods ... helped me to think very deeply and come up with alternative and sophisticated solutions to creative problems'.

Most students welcomed the brainstorming approach to idea generation implemented early in the course, however, two students commented that it was just 'mind mapping' and nothing particularly innovative; even though they acknowledged that the approach might be useful for 'other' students, 'It might work for some people but not so well for others. Only really suits a few types of learners'. Another challenge encountered in using the 'ideas' blog for scaffolding throughout the IDM course, was the tendency for some students to post their reflections to their blogs in the week ‘in the flow’ to maintain focus on the creative problem solving process throughout the duration of the semester.

3.1.4 Design of the CPS tool

The CPS framework therefore required considerable revisions over time, and as noted in the more detailed case studies reported elsewhere (see Wood 2010; Wood & Bilsborow 2013; Wood et al in press), the outcomes from each subsequent offering helped to improve on the approach throughout 2011.

An online tool (Ingenium) was designed in late 2011 based on the paper-based version of the CPS framework. This version of Ingenium incorporated the five stages of the CPS process with sub-sections comprising questions and prompts related to each of the five stages, which students access via arrows on each page (see Figure 2). Video clips were also included for each CPS stage to help guide students through the required tasks relevant to that stage. A pencil icon provided students with a link to a public blog site where they could set up and access their own blog account and another icon ('w') provides students with a link through to the project wiki. A menu was placed on the right-hand side of the interface providing students with a series of creativity tools including a ‘notebook’, ‘toolbox’ and ‘resources’ as well (see Figure 2). These sections included the social media and other supporting resources that the user might need throughout the creative solving process.
3.1.5 The redesign of Ingenium over successive iterations following a DBR approach

The DBR approach implemented in this study involved a research team comprising teachers, researchers and designers working in collaboration and the research approach employed mix-methods with multiple iterations involving designing, developing, trialling, evaluating, reflecting and redesigning informed by the previous iteration. The approach aimed to be consistent with the characteristics of DBR identified by The Design-Based Research Collective (2003) and follow the guidelines proposed by Reeves, Herrington and Oliver (2005). Details of the iterative cycles of design and redesign informed by the findings of a series of trial of the CPS tool over several offerings of the course are reported in detail in the following sections and also documented elsewhere (see for example Wood & Bilsborow, 2013; Wood et al, in press).

Preliminary trials of Ingenium were conducted in both semester one (Study Period 2; SP2) and semester two (Study Period 5; SP5) 2012. At the conclusion of the SP2 offering of the course, students were invited to complete the university’s approved anonymous online course evaluation. The evaluation included three custom open-ended text questions: 1) Did the creative problem solving process assist you in generating ideas for your topic and production? 2) Did you find the blog a useful approach to maintaining your journal of creative thinking and research? 3) What were your experiences using the creativity tool to generate your ideas?

Of the 250 students enrolled in the course, only 19 (7.6%) completed the online evaluation and even fewer responded to the open-ended questions. Nevertheless, student feedback combined with teachers’ observations and reflections on the experience did provide insight into the potential benefits and challenges in applying the tool in this first year course. Positive comments suggested that the course encouraged students to explore creativity in ways that they had not experienced in courses with more traditional assignments. Comments such as the statement by one student that ‘It was a good course to express creativity through a different format, one that was more interesting than just the regular essay writing in others’, and another who stated that ‘It helped to clarify the idea I had’ suggest that the approach had the desired impact. However, several students approached the task with a more closed mind and did not engage in the creative problem solving task as indicated by comments such as ‘No, everyone already had their ideas to start with and in doing this did not further develop them or create them’. Some students also expressed frustration with the repetitive nature of the process indicating that the tool had not adequately reinforced the value of creativity occurring through a process of multiple iterations involving research, design, testing, refinement, collaboration and reflection.
Ingenium was trialled again in the same course in SP5 2012. At the conclusion of this offering of the course, students were again invited to complete the same anonymous online survey. Twenty-seven students responded and of those, 48% reported that Ingenium raised their awareness of creative problem solving and helped them to think more creatively about their assignment; 41% indicated that they felt Ingenium would be useful to other areas of their studies; and 33% of students reported that they felt more confident about their creative skills after using the Ingenium.

While one student ‘found the tool a great catalyst for new directions in thinking …’ and another reported that it was a ‘Very good planning tool’, others were challenged by the presentation of the interface as suggested by one student who commented ‘I found the site rather hard to use. It was hard to follow the layout of the information and contained a lot of writing that could be cut down to be more accessible and concise’. Students were also challenged by the amount of time it took to complete the process, as comments such as ‘The principles and techniques are good, but the presentation and long winded nature make it unusable’ and ‘Thought it was very useable it was also slightly daunting because of the amount of subsections … this is incredibly tedious to work through’ suggest. When asked what improvements should be made to the tool students suggested: ‘Better structural layout’; ‘Include some visuals …’; ‘… perhaps find another way of presenting’; ‘it needs a complete overhaul design wise’.

Based on the feedback from two semesters of trials in IDM in 2012, Ingenium was redesigned to include new video examples and text-based instructions (see Figure 3). During the SP5 2012 trial, one teacher observed that students were not using the example videos noting ‘The students would begin playing the video and only watch it for a few seconds before closing it’. To address this issue, the ‘talking-head’ videos were replaced with short animations, designed to explain the stages of Ingenium in a more engaging manner.

![Figure 3: Redesign CPS tool with embedded video examples](image)

The text component of the tool was also redesigned during this version in response to student feedback suggesting that the language used was too abstract and not descriptive of the process. For example, ‘Problem Delineation’ was changed to ‘What’s the big picture?’ The procedural text descriptions were also simplified to address student feedback suggesting that the steps were too repetitive and long-winded.

The structure of Ingenium was also redesigned as a mind map (Figure 4) to provide a more creative, non-linear approach to the structure.
A new group of students enrolled in IDM undertook the same assignment to create the pre-production for a promotional video clip in the first semester (SP2) 2013. The students were encouraged to use the new mind mapping tool that would allow them to access the process in a non-linear fashion, but during the trial, technical issues with the mind mapping tool were encountered and many of the students were forced to return to the original linear, step by step instruction approach.

Sixty-two students responded to the online survey and their responses indicated an increase in the percentage of students who indicated that their awareness of creative problem solving had been improved through using the tool (48% in SP5 2012 to 55% in SP2 2013). Fifty-one percent of students reported that the tool had helped them think creatively compared with 48% during the previous trial, and 33% of students reported that they felt more confident about their creative skills after using the Ingenium, which remained the same as during the previous trial.

Many students responded favourably to the redesigned video examples with comments such as 'The YouTube videos linked to the pages were useful' and one teacher observed that unlike the previous trials, more students watched the videos in their entirety. However, several issues were encountered by the students as reflected by comments such as: 'The mind map ... is a useful tool, but very unreliable'; 'I liked how Ingenium was easy to use, however, I was not pleased with my mind map being entirely deleted days before my assignment was due'; and 'it would have been wicked, but it crashed a lot'. When asked what improvements should be made to the tool students reported that 'the menu structure should be made more easy to understand'; ‘it just needs to be fine-tuned so that the questions are less repetitive and the mind-mapping section works'; and 'work primarily on the user interface and the rest will come, as will interest'.

The student feedback from the three trials of Ingenium reported in the previous sections informed the next iteration of the design and development cycle. The major revisions included a move to a more robust approach to coding the site to avoid cross-browser issues, the redesign of the entire interface as a mind map with engaging graphics representing each stage of the CPS and each sub-section (Figure 5).
Students interact with each of the 'post-it' note image links to progress to sub-sections of each CPS stage and can embed their thoughts, research, images and links within the clouds relating to each sub-section. A toolbar above Ingenium provides students with the ability to navigate back and forth in a linear or non-linear approach as they work through the CPS stages. Students can also print out a report of their progress in outline format (Figure 6).

Figure 5: Revised Ingenium mind mapping tool

Figure 6: Revised Ingenium with report generator button
The revised Ingenium tool was trialled during the SP5, 2013 offering of IDM. Eight students responded to the online survey after completing their first assignment using the tool. Once again, there was diversity in experiences reported. Some students enjoyed the process as reflected by comments such as, ‘it enabled me to think outside the box in relation to my topic and brought forward some really valuable ideas’ and ‘I liked Ingenium as I am not a person with a creative mind’. But several students noted there were too many repetitive steps involved as indicated by comments suggesting ‘I liked the way that it stepped through each stage, but I believe the number of steps needed to complete was time consuming’. Similarly, one student stated that ‘there are too many sections which means you are constantly repeating yourself, also it is not clear what to put in each section’ and another suggested that ‘a danger was to spend far too much time filling in the various boxes/bubbles. It could very easily eat up time’.

Beyond the mechanics of the tool students reflected on how Ingenium allowed them to combine the processes of research and creativity. One student reported, ‘I found it interesting that we were asked to brainstorm, write down assumptions and deconstruct/reconstruct first then to do further research. Usually it is the other way around. I liked this approach as I didn’t have any pre conceived ideas or restrictions influencing my ideas, I do wonder how my ideas would have differed if I had researched first’. Often considered as two distinct stages, research and creative problem solving are brought together in this tool, enabling students to see the complementarity of the processes.

The feedback from many iterations of the DBR process indicates that there are still some issues to be resolved, particularly with respect to the repetitive nature of the steps. Based on the findings of these trials, further revisions are in progress reduce the requirement for students to complete reflective notes at the completion of each sub-section within the major stages of the CPS process. Rather, they will complete the sub-sections and then summarise their reflections for that stage of the process before moving on to the next stage. This revision will allow users to skip over the sub-steps that they feel are unnecessary. The revised version of Ingenium will be trialled in IDM during the first semester of 2014 and reported in future publications.

3.1.6 Design of guidelines informed by the findings

As noted in the preceding sections, an important feature of DBR is that the research results in the development of guidelines for use by other teachers. The guidelines arising from this study are documented in detail in the final report (Wood et al, in press), and include guidelines for planning to teach creative problem solving, strategies for teaching creative problem solving, and appropriate alternative approaches to assessing creativity. A brief summary of the guidelines follows:

Planning to teach creative problem solving: This set of guidelines acknowledges that changing to a new teaching method takes flexibility and practice, and a commitment to transforming the teaching and learning approach from teacher-centred to student-centred. The approach highlights the benefits of engaging students in activities in which they learn by design recognising that graduates need skills that enable them to respond to complexity and uncertainty in the workplace, and that skills require a level of tacit knowing and confidence that cannot be acquired from reading through the process alone.

Teaching creative problem solving: These guidelines emphasise the importance of teaching the value of creativity, valuing exploration and mistakes, building on students’ interests, enhancing opportunities for student collaboration, and embedding reflective practice in the curriculum.

Assessing creativity: Many teachers are unsure of how to assess creativity; however, alternative assessment approaches such as self- and peer-assessment are well suited as they encourage reflection and collaboration. Another important feature of assessing creativity is to focus on the process, rather than the end product; rewarding students for experimentation and learning from their mistakes through critical reflection on the process and acting on what they learn through the journey is in many ways more important than the final product arising from that process.

4. Conclusion

The study reported in this paper aimed to address the three major challenges affecting the capacity of teachers to incorporate creative problem solving approaches into their teaching and learning. These three challenges include the lack of an appropriate model to support them in making the required shift from
outmoded pedagogical methodologies to more creative approaches; the lack of a concise definition of creativity within policy documentation; and the lack of strategies to help teachers develop the skills to engage with creativity in their teaching and learning. The study involved developing a CPS framework and associated tools designed to scaffold students through the creative problem solving process and guide teachers in the design and redevelopment of the curriculum.

The DBR approach applied in the project ensured that the development of the CPS tools was responsive to student and teacher feedback through multiple iterations involving design, development, trials, evaluation, collaboration, reflection and revision. Consistent with a DBR approach, the research built on a strong theoretical foundation informed by creativity theories and contemporary research showing the benefits of creative problem solving in education (Amabile 1996; Robinson 2001; Titus 2006; Tosey 2000) and practical techniques to guide teachers, and support students undertaking creative problem solving activities (Titus 2000; The Global Creativity Corporation). The DBR approach is not without its challenges (see for example Anderson and Shattuck 2012; Barab and Squire 2004), as the highly critical feedback by students to early iterations suggest. However, the approach is appropriate for research that seeks to address ‘real-world’ problems through an iterative research process, which systematically refines the design, while also leading to the production of design principles and practical guidelines (Amiel and Reeves 2008: 34).

The study also highlights the value in students being integrally involved in the design and development of technology enhanced learning innovations. As the feedback documented in the preceding sections demonstrate, without such rich formative feedback, it would not have been possible to develop a CPS tool that meets the needs of students from diverse backgrounds. Moreover, as we came to realise when students started using the tool in their assignments, the DBR approach reflects the approach students themselves are undertaking in their assignments through the design based learning approach employed in the course. Therefore, an unintended benefit from the adoption of DBR as our preferred research design has been the enhancement of our understanding of the similarities between DBR as a research approach and design based learning, which in turn, is reflected in the final design of the CPS tool. As Vogt et al (2010) suggest, ‘learning by designing’ can facilitate deep learning and competence development through a complex series of activities involving students in the process of information gathering, problem identification and constraint setting, idea generation, modelling and prototyping, building, and evaluating.

The focus of this paper has been on the application of DBR to the design and development of a CPS framework and tool to support students. Although only one case study (a first-year undergraduate course) is reported in this paper, the same process has been applied in the trials of all 10 courses that were included in the study. Furthermore, this paper only reports the findings from trials of the CPS tool with students, even though the aim of the project was to design and develop a framework and tools to both scaffold teachers in the design of their courses and guide students in the application of creative problem solving within their courses. Research involving trials of the CPS tool with teachers are currently underway to assess the extent to which the framework and tool is effective in facilitating the kind of transformation in teaching practice required to support teachers in engaging with creativity ‘intentionally as an outcome of pedagogical work’ (McWilliam 2007a, p. 4).

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