PEDAGOGICAL SHIFT IN THE TWENTY-FIRST CENTURY: PREPARING TEACHERS TO TEACH WITH NEW TECHNOLOGIES

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ABSTRACT
The expectation in education today is that pre-service teachers should graduate from teacher education adequately prepared to teach with Information Communication Technologies (ICTs) that have potential to enhance curriculum delivery, hence improving quality of education. However, research shows that pre-service teachers are graduating from teacher education underequipped to teach with ICTs. The aim of this study is to understand why, given the deployment of ICTs for teaching and learning in teacher education, the new teachers remain underprepared to teach with ICTs. Qualitative research approach was employed in this study, whereby randomly selected pre-service teachers were interview respondents. Written reflections on their preparation to teach with ICTs also formed part of the data collected. Technological Pedagogical and Content Knowledge (TPACK) theory was embraced to guide the study. Analysis of the data shows that the main contributing factor of the new teachers’ underpreparedness to teach using ICTs is the quality of instruction they receive during their training.

Keywords: curriculum delivery, Information Communication Technologies (ICTs), integration, pre-service teachers
1. INTRODUCTION
There is a strong belief today in developing countries that Information Communication Technologies (ICTs) are powerful tools that can help bring about transformation in education, hence raising standards and quality of teaching and learning processes (Fu 2013). Consequently, quality education enhances the economic growth of the nation. Recently, Meador (2014) argued that in this century:

... technological advances have exploded. Schools have not been left out in these advancements. Classroom technology has become increasingly more popular ... technological tools ... provide teachers with methods in which they can actively engage their students in the learning process. Today's students are digital natives and as such use of technology in education has proven to be effective. (1)

In response to such arguments, ICTs meant for teaching and learning have been deployed to many schools in both developed and developing countries. In the case of the latter and in South Africa, for instance, and in particular the Western Cape Province where the teacher education institution involved in this study is located, all the public schools are equipped with ICTs (computers and interactive whiteboards) through the Khanya Project. This project was an initiative of the Western Cape Education Department (WCED) with the aim of deploying ICTs to schools. By 2011, all the public schools in the Western Cape had computer laboratories and most of these schools were also equipped with interactive whiteboards (Khanya 2011). The schools are also provided with Internet connectivity. During the deployment of the technologies, the Khanya Project trained the in-service teachers on how to use the ICTs (Chigona and Chigona, 2010). Most of the pre-service teachers graduating from the teacher education institution in the study are employed by public schools in the province. The newly-qualified teachers joining these schools are expected to have gained the skills and knowledge for teaching with the technologies from their initial teacher training.

Since the digital technologies in schools are here to stay, there is a need to shift pedagogical approaches. Keeping the traditional methods of teaching with new technology will not enhance the quality of instructions; there is a need for a shift in pedagogy in order to take advantage of the new technologies (Vrasidas and McIsaac 2001). Integration of new technologies in curriculum delivery would require changing the role of teaching whereby communication is not viewed as merely a one-way transmission from the instructor to the learner, hence embracing constructivism (Bavaro 1996).

Therefore, it is likely to assume that teachers joining the teaching professional from teacher training would be exposed to the pedagogical shift, hence be adequately prepared to teach with the ICTs deployed in schools. It is argued that the ongoing and effective use of new technologies for teaching and learning provides opportunities for learners to acquire technology capabilities, as well as enhancing curriculum
delivery (Bavaro 1996). However, research has shown that most teachers, including newly-qualified teachers, lack ‘Technological Pedagogical and Content Knowledge (TPACK)’; this is the skill and knowledge on how to integrate the ICTs into their classrooms for teaching and learning purposes (Koehler et al. 2013). Studies in South Africa show that both newly-qualified and experienced teachers in schools are lagging noticeably in the integration of the new technologies into curriculum delivery (Sherman and Howard 2012; Chigona and Chigona, 2010). It should be noted that the most common classroom ICTs (new technologies) referred to in this article include computers and interactive whiteboards.

While teachers who graduated from teacher education years ago depended on in-service training to be technologically competent and to be able to use the ICTs in class, the expectation for the pre-service teachers is that they should graduate from teacher education adequately prepared to teach with the tools. In other words, the new teachers will join the teaching profession with the necessary skills and knowledge required to teach, using ICTs, effectively. However, it is disturbing to learn that, as they are graduating from their teacher education, the pre-service teachers feel underprepared to teach with the ICTs. Most of the pre-service teachers are comfortable to teach the way they were taught (Britzman 1991), rather than try to be innovative by embracing the new technologies. Given that the twenty-first century is the digital age and that ICTs are here to stay (Good 2008), this article, therefore, sets out to understand issues leading to unpreparedness of the pre-service teachers to teach with the twenty-first century technologies which are believed to enhance curriculum delivery. The new teachers need to be equipped with TPACK to be able to teach with ICTs effectively.

2. TECHNOLOGICAL PEDAGOGICAL AND CONTENT KNOWLEDGE

TPACK theory, developed by Mishra and Koehler (2006), was used as a conceptual framework in this study. TPACK theory was deemed important because it:

… is the basis of good teaching with technology and requires an understanding of the representation of concepts using technologies; pedagogical techniques that use technologies in constructive ways to teach content; knowledge of what makes concepts difficult or easy to learn and how technology can help redress some of the problems that students face; knowledge of students’ prior knowledge and theories of epistemology; and knowledge of how technologies can be used to build on existing knowledge and to develop new epistemologies or strengthen old ones. (Mishra and Koehler 2006, 1029)

Educators know that teaching is not as simple as many people think; it encompasses addressing the complex, multifaceted and situated nature of teacher knowledge. Before the twenty-first century, one could be seen as an expert teacher (Koehler et al. 2013) if he/she was able to fuse the knowledge of subject matter (referred
to as content knowledge) with pedagogy (which is the understanding of how to make the content accessible to the learner). Now, with technologies coming in to enhance the process of teaching and learning, TPACK was developed to assist teachers in identifying the nature of knowledge for technology integration in their teaching. According to Mishra and Koehler (2006), expert teachers now are those who can bring together knowledge of subject matter, what is good for learning, and technology. Mishra and Koehler argue that this is more than simply bringing in ICTs to the old ways of teaching. They say it all depends on the skill of how technology is utilized to access content and to understand how it can support learning processes in combination with pedagogical and content knowledge. Nevertheless, the expectation today is that the newly-qualified teachers should be equipped to fuse the TPACKs and be able to teach in this digital age effectively.

2.1 ICTs in teacher education

While the expectation on newly-qualified teachers is that they should eagerly incorporate ICTs into their teaching, anecdotal evidence shows that not many are in the position to do so, due to their ill-preparedness from their teacher education. In other words, they lack the special skill of how to integrate the technologies into curriculum delivery (Mishra and Koehler 2006). Vrasidas and McIsaac (2001, 128) noted that for successful use of technology when teaching, teacher training should be responsible. The training should equip the pre-service teachers with a solid understanding of the various ICTs such as computers, interactive whiteboards, mobile technologies like smartphones and tablets, etc. their affordances and their constraints when integrated into curriculum delivery (Vrasidas and McIsaac 2001, 128).

Nonetheless, for Bingimlas (2009, 237) the integration of the new technologies into the classroom for effective instructions is not easy such that a teacher may encounter challenges in the process of using the tools in class. In trying to equip teachers with the skills to teach using ICTs, Vrasidas and McIsaac (2001, 128) suggest that the technological knowledge be taught within context because such skills could be best achieved while working on a meaningful task using the tools. In other words, educators should be trained to use the ICTs for constructing, organizing, and communicating knowledge to their learners.

It is believed that the quality of teacher training one receives may influence one’s teacher efficacy. Again, the teacher efficacy may determine whether the teacher would use the ICTs in his/her teaching (Skoretz 2011). She noted that teacher efficacy could influence the teacher’s technological efficacy (Skoretz 2011). In other words, if one were never modeled or trained to teach using ICTs, one would have low self-efficacy to integrate the tools into the classroom.
Tschannen-Moran and Hoy (2001, 783) have defined teacher efficacy as the teacher’s ‘judgment of his or her capabilities to bring about desired outcomes of student engagement and learning, even among those students who may be difficult or unmotivated’. On the other hand, technological self-efficacy is defined as ones confidence to successfully complete a task using modern technologies (McDonald and Siegall 1992). Teacher education training is believed to be crucial for many pre-service teachers, since a combination of the efficacies required for teaching are believed to develop during this training (Moore-Hayes 2011, 1).

Felicetti (2011, 2) believes that individuals join the teacher training with preconceived ideas and models experienced as learners. Such experiences may enhance or hinder development of proper teaching practices. Therefore, teacher education is responsible for shaping and modeling the new teachers on how to teach properly using ICTs, hence developing a positive self-efficacy in them. According to Moore-Hayes (2011), a positive self-efficacy belief is believed to be important during teacher training, since educators who have high levels of teacher self-efficacy feel confident to include innovative instructions in their classrooms.

2.2 Significance of ICTs in teaching and learning

It is important to note that many educators and school managers are becoming aware of the benefits of integrating ICTs into educational processes, and how the new technologies form an important part of the learners today. Apart from enabling transformation of pedagogy, the new technologies also provide teachers and learners with new ways to access and process knowledge in different fields (Mishra and Kohler 2006). It is believed that ICTs provide more flexibility, greater convenience, and the ability for learners to work at their own pace (Ferguson and Keengwe 2007, 2022). Cochrane (2010) is also of the opinion that ICTs can support constructivist pedagogy and create an environment where learners feel empowered to take charge of their own learning.

Considering the new wave of technological development and its impact on education, Cochrane (2010), citing Hameed and Shah (2009 ), shows that ‘a high level of cultural re-alignment is taking place which lies in the acknowledgement that education is not dependent upon where we go, but what we learn through the opportunities and flexibility afforded by mobile and internet technologies’. However, this scenario requires a shift in pedagogy in order to realize the benefits the technologies can offer.

There are numerous ways of integrating technology in teaching and learning, as technology has the potential to enable a rich context for learning. Technology-rich environments allow learners to experience real-life scenarios, construct multiple perspectives, and reflect on their learning (Vrasidas and McIsaac 2001 128). Several
rich interactive multimedia systems exist in the market that can allow learners to work in a community of practice (128). Many learners today own some types of these systems, for instance, touch screen smartphones and tablets that could be useful for teaching and learning.

3. RESEARCH METHOD

This is a case study of one teacher education institution and its approaches to integrate ICTs into pedagogical preparation of new teachers. This case study was conducted using a qualitative research approach, whereby the pre-service teachers’ written reflections and focus group interviews were used to explore their preparedness to teach with new technologies, changing behaviours and conflicts. The questions that gave drive and focus to this study were:

i. Why are newly-qualified teachers ill-prepared to integrate ICTs into curriculum delivery?

ii. What needs to be done to improve the teacher education to ensure that new teachers are adequately trained to teach with ICTs?

As indicated above, qualitative research approach was used and TPACK was embraced as a conceptual framework in this study.

4. SAMPLING

Random sampling was used to select final year pre-service teachers from a teacher education institution in the Western Cape in South Africa. Fourteen pre-service teachers were sampled from a class of 60 students to participate in two different focus group interviews. The population was a class of students being trained to teach Intermediate and Senior Phase. This class was purposively targeted because, during their final year of teacher education, the pre-service teachers were involved in a digital storytelling project which re-enforced the use of different digital technologies which are commonplace in many classrooms in the Western Province today. Again, the digital storytelling was introduced to the class as a teaching tool and every student in this class of 60 had to go through the experience of producing his/her own digital story. A digital story is a simple multimedia movie that combines photographs, video, animation, sound, music, text, and often a narrative voice (Craig 2006). At the end of the project, all the pre-service teachers in this class were asked to each write a reflection on the production of the digital stories and how ready they thought they were to use the digital technologies for teaching when they had finished their teacher training. All 60 reflections were used as data for this study.
4.1 Data analysis

The interviews with the 14 randomly selected pre-service teachers from the class of 60 above were audio-recorded, following the consent of the participants. The audio-recorded interviews were then transcribed verbatim. Qualitative data analysis was used while bearing TPACK in mind; thus both deductive and inductive approaches were used. Nonetheless, the analysis of the data collected followed much of a deductive content analysis (Elo and Kyngäs 2008). Three of the TPACK constructs were used as predetermined categories: technological knowledge, technological pedagogical knowledge and technological pedagogical content knowledge. This was preferred because the author was interested in understanding the technological knowledge of the pre-service teachers; and also interested in their capabilities to integrate different technologies into their curriculum delivery, i.e. technological pedagogical knowledge and technological pedagogical content knowledge. In a nutshell, deductive analysis was employed in this study simply to use the concepts from the TPACK theory as sensitizing concepts (Gilgun 2005). While analysing the data, the author specifically looked for themes in relation to the TPACK constructs. Using Creswell’s (2007) advice, the author employed openness and flexibility to any additional codes which could emerge during the data analysis processes. This gesture allowed the codes to reflect the experiences of the respondents from an emic perspective (Creswell 2007).

4.2 Ethics

Permission to conduct such a study at the teachers’ education institution was obtained from the Research Ethics Committee in the Faculty of Education, right from the beginning of the research. Privacy and confidentiality concerns were given the deserved consideration at all times (Cohen, Manion and Morrison 2007). Consent to use the pre-service teachers’ reflections was obtained from the whole class when asked to write their reflections. Again, permission to record conversations with the participants was also obtained from each of the individuals taking part in the interviews. For anonymity, no identifications of the interviewees or the authors of the written reflections were used in the reporting on the findings. The name of the institution was also not provided.

5. FINDINGS AND DISCUSSIONS

Results of the study show that there are a number of challenges that influence the pre-service teachers from not integrating the technologies in their classrooms; hence unable to take advantage of the ICTs for their own development as teachers, and their learners for the preparation of the competitive job market which more and more requires people with well-developed technological skills. The pre-service teachers
would rather use traditional methods of teaching as opposed to teaching with ICTs, because they feel comfortable to teach the way they were taught. When the pre-service teachers were in school, their teachers did not use digital technologies in class; similarly, their instructors in the teacher education did not adequately expose them to teaching with technologies. It was interesting to note that the written reflections and the data from the focus group interviews spoke to each other. The following themes were used to organize and present the findings of this study:

i. Pre-service teachers’ technological knowledge

ii. Instructors’ attitude and use of ICTs for curriculum delivery

iii. Pre-service teachers’ ability to integrate ICT into pedagogy

iv. Digital natives’ classroom

5.1 Pre-service teachers’ technological knowledge

When the pre-service teachers join the teacher education, they are offered a computer literacy course. Consequently they are not allowed to submit hand written assignments. Therefore, by the end of their four years of training at the institution, all the pre-service teachers have had some experience with technology. However, the experience does not go as far as how to integrate the technologies into classrooms. Nevertheless, there are some who, compared to their colleagues, have higher computer self-efficacy (the judgement of one’s capability to use a computer [Compeau and Higgins, 1995, 192]); others’ confidence to use the different technologies for their learning processes is very low. This is reflected in one of the respondents who, during the interview discussions, narrated what had happened in the participants’ final year teacher professional course where they had gone through a digital storytelling production experience.

You know I didn’t think there were any moments where somebody who was here who didn’t understand or know how to use technology. Now I understand okay. I know how to use a computer now. Like Lesley said he helped two or three people. I helped two or three people and then I know lots other people who helped a few people to set up their stories with this programme that is so easy to use but after their story they still didn’t know how to use the programme.

This narration is similar to a number of reflections by the students in the study. This proves that pre-service teachers are graduating from the teacher education programme with different efficacies to use computers (the common technology used for teaching and learning in most schools in the Western Cape). However, the institution does not seem to place much emphasis on the technological skills that the pre-service teachers need to acquire for their own future work in their classrooms when they become qualified teachers. In other words, that there is provision of computer literacy classes
is not enough for the pre-service teachers’ preparation to teach with ICTs. Vrasidas and McIsaac (2001, 128) have argued against instructing the pre-service teachers about ICTs. For these pre-service teachers, they recommend teaching or modelling how to use ICTs for teaching and learning, whereby technological skills are not taught out of context, since one can best learn how to use an ICT while working on a meaningful task (2001, 128).

5.2 Instructors’ attitude and use of ICTs for curriculum delivery

While it may be assumed that instructors in the teacher education do integrate ICTs for teaching and learning into their instructions to the pre-service teachers, many do not. They themselves do not have the confidence to integrate the new technologies into their teaching. Most of them are stuck in their old ways of teaching; they are not willing to change to the new teaching approaches where technology is used to enhance the teaching and learning processes. Nevertheless, the argument is that if the pedagogical shift required in the twenty-first century is to be successfully rolled out, that shift should start with teacher educators. In other words, teacher educators need to embrace the new pedagogies and model them to their pre-service teachers. During data collection one respondent said:

My impression is that not all lecturers use it (technology), as different lecturers have different abilities. … They are stuck in their ‘old’ ways of doing things and therefore not open to new methods of teaching.

It has been argued that, although all instructors in teacher education have computers in their offices, this does not easily translate to teaching with technologies. The instructors themselves need to acquire the skill of how to teach with new technologies. As long as the instructors do not use the ICTs in their instructions, or if they do not use the technologies effectively in their curriculum delivery, the pre-service teachers under their instructions are likely to graduate from the teacher education underprepared to teach with ICTs in schools. The written reflections of some pre-service teachers in the study indicate strongly that it is the instructors’ responsibility to ensure that they are modelled to teach with the new technologies. They argued:

It is the lecturer’s job to prepare us for the realities of teaching as teaching is undergoing change with the availability of ICTs. If they do not show us what is available and possible, we will not know about it.

In line with the argument above, other authors such as Jung (2005, 94) recommend that ‘to use these tools effectively and efficiently, teachers need visions of the technologies’ potential, opportunities to apply them, training and just-in-time support, and time to experiment. Only then can teachers be informed and confident in their use of new technologies’.
5.3 Pre-service teachers’ ability to integrate ICT into pedagogy

It is argued that technological skills ought to be taught to the pre-service teachers within the pedagogical perspective, not separately as is the case with the computer literacy class (Vrasidas and McIsaac 2001). Analysis of the data collected for this study shows that although the pre-service teachers have attended computer literacy courses, they do not all feel confident to integrate the ICTs into their pedagogy. Lack of confidence to teach with the technologies is argued to originate from the instructions the pre-service teachers had received during their teacher education. The instruction did not prepare the pre-service teachers on how to integrate the ICTs into their teaching. In other words, they are not modelled on how to teach with the technologies. Unfortunately, having high computer efficacy may not translate into knowing how to teach using the technologies. One respondent on behalf of his colleagues said:

We don’t feel prepared to teach with digital technologies because we haven’t been taught how to.

Another one who feels her computer efficacy is high said:

… but it’s our own effort … we’re not that confident but we are somehow self-equipped but that we may be scared – we’re a bit scared that we’re going to use a certain way that’s wrong at a certain moment …

In most written reflections, the concern about lacking confidence to teach with the technologies was also commonplace. For instance one wrote:

I am not sure if I will be able to use the technologies we have been exposed to in the project without someone helping me at school.

The quotes above show that as long as the pre-service teachers lack the knowledge of how to integrate ICTs into their instructions for effective curriculum delivery, they will not feel confident to teach with the technologies, regardless of their technology efficacy. This is in line with Mishra and Kohler (2006) who have argued that TPACK is necessary for effective teaching with technologies. Unfortunately, this type of knowledge is not imparted to the prospective teachers.

5.4 Teaching digital natives

Digital natives are said to be those who were born into the digital age (Helding, 2011). Many learners in the Western Cape have access to new technologies for communication and spend most of their free time playing and/or chatting on such platforms as MXit, Facebook, video gaming, etc. (Walton and Donner 2012). Chigona (2014, citing Quinlan 2014) shows that, with increased exposure to new technologies, such learners are more skilled than their teachers in the use of
technology. Teaching these digital natives using traditional methods of teaching may not be effective as anecdotal evidence shows that today’s learners perceive such instructions as dry. Kivunja (2014), showed that:

… the reasons why there was an apparent decline in education in the USA in the last decades of the 20th century lie primarily in the advent of digital technology which had been widely embraced by American students, outside school, across all ages of learners from K-12 through to college, but not applied in the classroom. (100, citing Prensky 2001)

It is, therefore, not surprising that pre-service teachers are getting more and more concerned about the skills they have acquired during their teacher training, in particular on how to use ICTs in the digital native classrooms. During the interviews one participant, who acknowledged the need to teach digital natives with technology, lamented:

I still don’t know how to use the interactive smart board for teaching … with Maths especially we could shape circle, triangles, you can do angle perimeter like … but we don’t know how to use the technology because we weren’t taught like … plan a lesson and then and you do like for example Maths lesson and then you do … we weren’t taught that.

ICTs enable limitless access to information so that the average person consumes three times as much information each day as he/she did a few decades ago, hence technology is rewiring the human brain, causing cognitive revolution (Helding 2011). The revolution necessitates a pedagogical shift from ‘how well teachers teach, to how well students learn; therefore, understanding the cognitive implications of technology is essential for teaching the new tribe of digital natives’ (Helding 2011). Failing to integrate technology in the digital natives’ classroom means that teachers and learners are not speaking the same language, so effective learning may not occur.

It should be noted that taking advantage of the digital technologies for teaching and learning within a developing world would help in dealing with issues concerning lack of resources like libraries in poor schools. Using mobile technologies which are accessible even in poor rural areas both teachers and learners could access academic information from the Internet.

6. CONCLUSION

In a nutshell, we see that there is a problem that prevents pre-service teachers from integrating the technologies into their pedagogy hence unable to take advantage of the ICTs for development. Even after spending four years being trained to be a teacher, the newly-qualified teachers only use traditional methods of teaching such as ‘chalk and talk’, as opposed to teaching with ICTs, because they feel that they have not been prepared by their teacher education programme to teach with the new technologies. Their instructors have equipped them with content and pedagogical knowledge but not with TPACK which could help them make sound decision as
to how and when appropriate or not to use given digital tools. Instructions for pre-service teachers that do not include TPACK are more likely to leave the new teachers underprepared to teach the twenty-first century digital natives, as has been argued by Koehler et al. (2013). According to Mishra and Kohler (2006, 1017), skills embedded in the TPACK of an educator are not the same as knowledge of a discipline expert, neither of a technologist nor an education psychologist. When teaching any subject, the educator needs to integrate carefully the subject content, the pedagogy to be used and the appropriate ICTs. It is a concern, therefore, that the pre-service teachers’ instructors seem to have no idea of what TPACK can do for the new teachers.

Since the analysis of this study shows that the pre-service teachers’ underpreparedness to integrate ICTs into their teaching is rooted in the quality of instructions they receive from their teacher education, there is a need to empower teacher education instructors to frequently model how to teach with ICTs for these pre-service teachers. The twenty-first century is the digital age even in the developing nations and ICTs are here to stay, hence instructors in teacher education have the responsibility to show or model effective ways of teaching with digital technologies for pre-service teachers. However, from the findings of this study, it is shown that the instructors themselves are in need of TPACK. It is, therefore, recommended that, when teacher education institutions, are acquiring new technologies, they should ensure that the intended users (instructors) are in a position to adopt and use the technologies effectively. The process of acquisition should include training the users (instructors) how to effectively and efficiently use the ICTs for instruction delivery.

Nevertheless, while there are some instructors who are willing to acquire TPACK, some are still not willing to take time to learn about the effective ways of teaching using the technologies. They are comfortable teaching using the traditional ways, as the use of technology in the classroom requires the teacher to embrace constructivism. Some of these instructors perceive the use of the technologies in their teaching as an ‘add-on’ as they and their students may need to invest some time to learn how to use the tools effectively in class (Chigona 2011). However, it should also be noted that some of the instructors are not innovative in their teaching because they are technophobic. In most cases, the technophobia is instilled because the individuals do not understand the benefits of learning and implementing the technologies. In the case of the teacher education instructors, it should be stressed to them the necessity of preparing the new teachers adequately to teach the digital natives. It should be the institution’s responsibility to ensure that all teacher education instructors have the skills necessary to fully prepare the pre-service teachers to teach in the digital age. This could be complemented by ensuring that there are sufficient technology-related courses along with disciplinary content courses. Strengthening teacher preparation on how to integrate ICTs into curriculum delivery should be the focus of teacher education in developing countries if these nations are to successfully shift the pedagogy to satisfy the digital age teaching paradigm and the social-economic development of the citizens in the twenty-first century.
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NOTES ON CONTRIBUTOR

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