INFORMATION AND COMMUNICATION TECHNOLOGY AS A TOOL FOR TEACHING AND TEACHER DEVELOPMENT: A CASE STUDY OF MTHUNZIWOXOLO SECONDARY SCHOOL, KWAZULU-NATAL

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Abstract

Modern technology has transformed every aspect of human life. In the education sector, Information and Communication Technology (ICT) has the potential of changing teaching and learning to make it more effective, efficient and responsive. Teachers are increasingly facing the challenge of improving their teaching skills because of the availability of teaching resources available to them as compared to teachers in the past two decades. Among these resources is the availability of ICTs which can transform their teaching approaches. Mthunziwoxolo is a secondary school in KwaZulu-Natal that has recently been provided with tablets in 2016 to be used for teaching and learning.

This study was conducted at Mthunziwoxolo secondary school because the school experienced a problem with learner performance and teaching approaches. The study attempted to determine whether ICTs act as an agent of change for teaching and teacher professional development. Qualitative research data was collected using semi-structured interviews from 10 teachers of Mthunziwoxolo secondary school. The data was analysed using thematic analysis. The findings indicate that infusing ICTs into teaching: (1) improves the working conditions of teachers; (2) improves teacher to teacher communications; (3) transform educators’ teaching methods to a combination of traditional instruction and learner-centred approaches; and (4) improves teachers’ professional development. However, the study reveals that effective ICT integration requires effective teacher professional development and support.

Based on the results of this study, the school should concentrate on fundamental pedagogical strategies in combination with ICT use for teaching and learning. Good strategic planning combined with effective teacher professional development is recommended if ICT integration into teaching and learning is going to be efficient, effective and responsive.

It is recommended that the school implement ICT-enhanced Teacher Development Model (ICTeTD) (Engida, 2011:17-21). The school must also enrol its teachers in the OER4Schools programme so that they gain professional development (Hennessy et. al., 2015:541).

Keywords: Educational Technology, Teacher development, Teacher professional education.

1 INTRODUCTION

Policymakers agree that “…access to ICT can help individuals to compete in a global economy by creating a skilled work force and facilitating social mobility” (UNESCO-UIS, 2015:05).

ICT in education brings the following benefits to the education system: (1) improvement in learning and giving learners better skills such as cognitive skills; (2) provision of equal education for all, especially to those learners in rural and marginalised areas; (3) enhancing teacher training and professional development; and (4) reducing educational costs (UNESCO-UIS, 2015:05).

According to Rajeswari and Sarawanakumar (2013:134), for the past twenty years ICTs have transformed how business and government have been operated. They argue that, in education ICT use has not been extensive yet. They further argue that since education depends on individuals, its quality has largely depended on the quality of teachers available. They quickly point out that ICT use in education results in learner-centred approaches to teaching and learning and this has resulted in conflicts between some teachers and learners. They conclude by stating that in the 21st century the role of ICT in education will be much more pronounced as the world move towards the information age dominated by digital media (Rajeswari & Sarawanakumar, 2013:134).
Teachers are increasingly facing the challenge of improving their teaching skills because of the availability of teaching resources available to them as compared to teachers in the past two decades. Among these resources is the availability of ICTs which can transform their teaching approaches (Msilà, 2015:1974). According to Msilà (2015:1974), in one South African Province of Gauteng, teachers and learners were provided with tablets in 2014 replacing the chalkboard and textbooks. The expectation is that schools across the country will move towards a paperless classroom. This hopefully will improve teaching and learning.

According to Nkula and Krauss (2014:242), ICT is not the solution for educational problems but they offer the potential to advance student knowledge and skills, foster co-operative and autonomous learning (Rajeswari & Sarawanakumar, 2013:135), and encourage students to move away from traditional approaches to learning to new learning approaches which are learner-centred (Naicker, 2010:685; Rajeswari & Sarawanakumar, 2013:134; Tok & Sora, 2013:283). Nkula and Krauss (2014:242) thus argue that ICT can add value to curricula and transform students into knowledge constructors. Tok and Sora (2013:283) also agree to this by emphasizing that this is true especially in schools with adequate ICT resources available for teaching and learning.

In South Africa ICT is not distributed equitably and stakeholders are not adequately involved in ICT integration (Mdlongwa, 2012:3). He argues that ICT use must have educational goals but this is not happening in South Africa. The reason for this dilemma is the lack of training in teachers on how to integrate ICT into education (Mdlongwa, 2012:4). This has caused integration to be concentrated on gaining ICT skills rather than using ICT as cognitive tools (Goktas et al., 2013:216). Therefore ICT integration is a constraint that must be dealt with if ICT use in education is going to be a success (Goktas et al., 2013:212; Adu and Galloway, 2015:245).

1.1 ICT integration into teaching and learning

ICT use in teaching and learning is a complex process especially for those schools that do not have enough ICT resources for teaching and learning. These schools tend to concentrate on learning about ICT than using ICT for teaching and learning (Goktas et al., 2013:216).

Anderson (2010:33) presents a model for successful ICT use in the classroom as shown in Figure 1 below.

![Figure 1: ICT stages in Teaching and Learning](http://www.unesco.org/new/en/unesco/resources/online-materials/publications/unesco-database/)

This model describes the levels of ICT integration by teachers in relation to stages of ICT integration of the institution and the corresponding pedagogical use of ICT in teaching and learning in each stage. The first stage is when the school is introduced to ICT. This is the emerging stage of ICT integration. The school has just acquired a computer and a printer and ICT is concentrated on ICT literacy. Teachers use ICT for administrative purpose and other professional use. Teaching is mainly teacher-
The second stage of ICT integration is when schools have acquired more ICT resources. The school may have acquired more computers and teachers may have access to laptops and smartphones. Teachers begin to use ICT to improve their teaching approaches. This is the applying stage of ICT integration (Anderson, 2010:31-36).

In the next stage teachers have an understanding of which ICT to use to teach a particular subject. The school has enough ICT for every classroom. This is the infusing stage of ICT integration. The last stage of ICT integration is when schools become specialists in using ICT. This is the transforming stage of integration. Teachers are able to transform their teaching approaches to learner-centred approaches. Learners are encouraged to be knowledge constructors (Anderson, 2010:31-36).

Avidov-Ungar and Iluz (2014:210) argue that there are three major levels of ICT use. These are ‘basic’, ‘focused’ and ‘creative’. At the ‘basic’ level teachers use ICT for simple and basic instruction. However, teachers at this level lack basic technological skills and therefore find it difficult to combine ‘content, knowledge, pedagogy and technology’ to teach. Teachers at the ‘focus’ level are committed to teaching using ICT and they manage to use ICT for their professional purposes but they still use traditional teaching methods. At the ‘creative’ level teachers use cooperative teaching methods to create innovative teaching strategies. These teachers are open, flexible and motivated to teach using ICT. Therefore teachers can move from one level to the next level depending on the teacher’s knowledge and understanding of ICT and pedagogy use (Avidov-Ungar & Iluz, 2014:210).

According to Kihoza et al. (2016:61) successful ICT integration into education requires more than just knowledge of the content, technology and pedagogy. They argue that teachers must have skills to improve social engagements such as teacher to learner and teacher to teacher communications. They maintain that there are teachers’ characteristics that are important for ICT integration. These are:

- Teachers’ understanding and knowledge of the subject and how it can be used to select appropriate ICTs to teach.
- Capability of the teacher to make choices between available ICTs for teaching so that educational goals are met.
- Teachers self-efficacy with regards to the technology and the subject itself; and
- Good lesson preparation that encourage learners to be knowledge constructors and learn autonomously (Kihoza et al., 2016:79).

Buabeng-Andoh (2012) reports on a literature review of the factors that determine the successful implementation of ICT into teaching. They are ‘individual’, ‘institutional’ and ‘technological’. They argue that these factors are interrelated (Buabeng-Andoh, 2012:147).

At the ‘individual’ level, “teachers’ feelings, knowledge and attitudes” are very important. Teachers with a positive attitude towards ICT adoption and use tend to integrate ICT successfully. At the ‘institutional’ level, enough support both managerial and technical is important. Enough funds must be provided to the institution so that it can procure enough ICT resources and also maintain it. Lastly, the institution must be able to provide adequate training and professional development to the teachers. The most important factor determining the success of ICT integration is teachers’ perception about pedagogical use of ICT. If teachers believe that ICT will not produce desired educational goals, their tendency will be no integration of ICT into teaching. This means that there must be strategies to reduce the space between educational goals and technological goals. If the strategies are missing ICT integration will fail (Buabeng-Andoh, 2012:147).

Other researchers argue that the frequency with which teachers integrate ICT into their teaching depends on the teachers’ self-efficacy about ICTs and subject content. Self-efficacy refers to the capacity of the teachers to provide desired results when using ICT in teaching. They maintain that when teachers have high self-efficacy, they tend to be successful in ICT integration (Tok & Sora, 2013:283).

Successful uses of ICT in education include computer based instruction (CAI), computer managed instruction (CMI) and computer based instruction (CBI) which uses stand-alone computers for teaching and learning, (Tok & Sora, 2013:283). Tok and Sora argues that computers were originally not designed for teaching and learning but advances in digital technology enabled CAI, CMI and CBI. They further maintain that it has brought to life concepts such as online learning, e-learning, virtual learning, e-coaching, e-education, e-journal, e-books and m-learning. This has enabled the following processes in education: teaching, diagnostic testing, remedial teaching, evaluation, psychological
testing, development of virtual laboratory, online tutoring, development of reasoning and thinking; and instructional material development (Tok & Sora, 2013:283).

However other researchers have argued that there are no links between computer-based learning and pupil achievement. They list three other important factors to consider when integrating ICT, these are:

- how the teachers and learners use ICT;
- considering other strategies to improve learner performance; and
- ICT equipment provision without proper support will not result in proper integration (Higgins, 2014:6).

1.2 Impact of ICT on the working conditions of teachers

It is important that the working conditions of teachers are improved for them to teach effectively. In a school like Mthunziwoxolo secondary school, teachers work in overcrowded classrooms. If these conditions are not attended to they can lead to poor learner performances. ICT integration into education has the potential to address such challenges.

Integrating ICT into education allows teachers and learners to share classrooms and computer laboratories. When computers are connected through a network they can cover a large area and learners and teachers are able to communicate over a large distances (Adu & Galloway, 2015:245). This means that a number of learners from the same district can be taught by a single teacher. This can go a long way in solving the problem of overcrowding and shortage of teachers especially in rural areas of South Africa (Adu & Galloway, 2015:245).

According to Adu and Galloway (2015:245), networking resources can reduce teachers’ workload. They argue that networking allows teachers to use digital tools such as video presentation, power point presentation and video conferencing. They further argue that video conferencing can be used to conduct school meetings, developmental workshops and teaching. Therefore participants in the conference can be able to communicate easily over large distances thereby sharing best teaching approaches. This can reduce the cost of delivering quality education reduce travelling costs for both teachers and learners and make learning much easier and affordable. Teachers and learners can also share computers, textbooks and other learner teacher support materials through networking resources. This means that technologies such as videos can be used to convey information through television networks throughout the whole school or even between schools or district, province, country or even the whole world. In this way the cost of delivering education can be reduced and all learners can receive quality education even in under-resourced areas. This also can vastly improve the conditions under which educators work (Adu & Galloway, 2015:245).

Other researchers argue that working conditions of teachers can improve if they are proficient in ICT use (Mathevula & Uwizeyimana, 2014:1094). According to Lawrence and Veena (2013:3), teachers gain basic ICT skills such as managing electronic files, using computerised databases and spreadsheets, ability to use e-mail messaging, and creating documents using graphical tools. They further argue that teachers can go on to gain expert computer skills such as the ability to use online resources, the ability to produce desktop publishing documents, presentations using digital multimedia tools, the skill to choose relevant software that match learners’ needs, be able to keep accurate student records and other administrative duties required for professional teachers, and gain an awareness of how to communicate and share information taking into account intellectual properties (Lawrence & Veena, 2013: 3).

In addition sciences and mathematics teachers gain more technical skills such as the skills required to assist visually impaired learners (Lawrence & Veena, 2013:5).This means that when teachers are proficient in using ICT their work and conditions they work under is improved. These competencies may be gained through appropriate training and professional development in ICT.

1.3 Impact of ICT on teacher to teacher communications

It is important that teachers communicate with their peers in the same school and with other teachers in neighbouring schools and around the globe. An important communication strategy is the formation of Personal Learning Networks (PLNs) (Anderson, 2010:107).

PLN is “the entire collection of people with whom you engage and exchange information, usually online” (Anderson, 2010:107). Teachers can use “e-mail and Web 2.0 tools such as blogs, wikis,
Facebook, Twitter, LinkedIn, online collaboration tools” to communicate so that they can share best teaching approaches. PLNs can be used in the following ways:

- To communicate with subject advisors and subject specialists.
- To obtain digital resources for teaching.
- To obtain detailed lesson plans from specialist teachers.
- To gain an understanding of the latest available ICT tools available for teaching.
- To access collaborative materials for teaching.
- To establish connections and obtain latest educational material (Anderson, 2010:107).

This means that PLNs are a powerful strategy for continued professional development of teachers. Through professional collaboration teachers can share best teaching approaches especially in areas such as teaching of critical subjects such as Mathematics, Accounting and Physical Sciences.

One powerful concept emanating from PLNs is professional Communities of Practice (CoPs). CoPs are “formed by people who engage in a process of collective learning in a shared domain of human endeavour…who share an interest, a craft, and or a profession” Anderson (2010:108). Therefore a community of teachers who are coming together with a sole purpose to share best teaching approaches using ICT form CoPs (Anderson, 2010:109).

According to Anderson (2010:109), CoPs are a part of e-learning in which richest communication occurs. Teachers use web tools to communicate with their peers and thereby share best ideas and experiences about teaching using ICT. One successful use of web tools is when teachers use Twitter for professional development (Anderson, 2010:110).

### 1.4 Impact of ICT on educator’s teaching methods

The provision of solid, quality education depends on good teaching. In order to deliver quality teaching requires that teachers must be capacitated to teach using ICT. The United Nations Educational, Scientific and Cultural Organization International Institute for Capacity Building in Africa (UNESCO-IICBA) believes that there must be quality teacher training and development in order to ensure that teachers are capacitated with high competency standards in pedagogical ICT use. In response to this UNESCO-IICBA came up with a strategy in 2009 called ICT-enhanced Teacher Standards for Africa (ICTeTSA) which will ensure that teachers are capacitated to deliver ICT-enhanced teaching (UNESCO-IICBA, 2012:15).

According to Engida (2012:14), ICTeTSA has six standards that are interrelated which teachers must achieve in order to integrate ICT pedagogically. This is shown in Figure 2 below. These are:

**The Six Standards of ICTeTSA**

![Image of the six standards of ICTeTSA](image-url)

*Figure 2: The six standards of ICTeTSA (adapted from UNESCO-IICBA, 2012:15)*
1 Engage in instructional design processes

Instructional design is a concept that ensures that learning and instructional theory is used to develop instructional methods for teachers. This competency incorporates content knowledge which is the knowledge of the subject that the teachers must teach, pedagogical knowledge which is knowledge of the teaching methods that the teacher must use in order to teach a particular subject, technological knowledge which is knowledge of the correct kind of technology to use in teaching a particular subject and how these interact. Teachers are also capacitated with regards to materials and activities to be given to learners and how to evaluate the success of these activities.

2 Facilitate and inspire student learning, innovation and creativity

This competency will ensure that teachers are able to develop and facilitate innovative and creative lessons that will inspire learners. This can be achieved if teachers experiment with digital media technologies and constantly evaluate the effectiveness of their teaching approaches. PLNs and CoPs are some of the strategies that may ensure that teachers gain this competency.

3 Create and manage effective learning environments

Teachers must be able to create an environment that ensures that they use learner-centred approaches to teaching and learning and also are able to encourage learners to be problem-solvers. Teachers can use a number of web tools in order to create such an environment.

4 Engage in assessment and communication of student learning

Teachers must be able to compile assessment tasks using digital media and also use technology to give feedback to learners.

5 Engage in professional development and model ethical responsibilities

Teachers’ professional development (TPD) is “the body of systematic activities to prepare teachers for their job, including initial training, induction courses, in-service training and continuous professional development within school settings” (Engida, 2012:18). TPD can be implemented using professional development schools (PDS). In the 21st century PDS can be implemented using technology. This is called electronic PDS (ePDS). According to Engida (2012:18) ePDS has the advantage over regular PDS in that it can be supplemented with ‘cyberspace’ dimension, which enable intensive communication between all the members in a school. Teachers should also take into account the ethical considerations when using ICT for teaching and also convey these to their learners.

6 Understanding subject matter for use in teaching

Teachers must have an understanding of subject matter for teaching. According to Engida (2012:18), there is a difference between a teacher and a content specialist. They argue that teachers are different from content specialist in that they know how to organise and use the subject matter knowledge whereas content specialist knowledge is based on research and is concentrated on generating new knowledge (Engida, 2012:18).
A different digital tool allows learners to acquire different set of skills and result in different teaching approaches. He argues that using basic ICT tools allows learners to gain basic skills and result in traditional teaching approaches. When integrated learning systems are used for teaching learners gain better thinking skills and a teaching approach shifts towards coaching. Using productivity tools allows learners to gain even better thinking skills and a shift in teaching approach towards an emerging teaching approach which is constructivist in nature. When teachers use e-communications via video/audio/data or online environment or problem solving with real data sets or online research or simulations or expression or visualization learners acquire high order skills as the teaching approach is transformed to being learner-centred (Engida, 2014:20).

Research has shown that there are many possibilities that can be provided by ICTs to teachers (Chigona et al., 2014:2). ICTs can help teachers to teach using a constructivist approaches. These approaches enable learners to gain cognitive skills, critical thinking skills and information accessing, evaluation and synthesising skills (Chigona et al., 2014:2). Kihoza et al. (2016: 61) argues that ICTs give teachers a number of alternatives when teaching. Teachers can use mobile technologies to communication over large distances thereby changing teachers’ teaching approaches. One example of using ICTs in teaching is through blended learning. Blended learning enables mixing of ICT use and old teaching approaches. It is a method where digital contents can be used offline or online, downloaded or provided in an electronic format such as e-book, media graphics, images, podcasts, video files, simulations, animations, online tutorials and assignments, subject related webpage files and Web 2.0 tools (Kihoza et al., 2016:62). In this way teachers’ teaching skills can improve.

1.5 The extent to which ICT can change teachers’ professional development

Teachers’ professional development (TPD) is “the body of systematic activities to prepare teachers for their job, including initial training, induction courses, in-service training and continuous professional development within school settings” (Engida, 2012:18). According to Hodges (2015: 591), professional development involves a process “of remaining current in one’s professional area of expertise, which includes functioning as a professional community”. TPD can be implemented using professional development schools (PDS). In the 21st century PDS can be implemented using technology. This is called electronic PDS (ePDS) (Anderson, 2010:107).

According to Hodges (2015:591), there are two types of professional development: formal professional development and informal professional development. He argues that formal professional development involves structured activities or courses. He further argues that that activities or courses can be
offered by schools, school districts, universities, colleges of education, independent organisations, government agencies, associations which are concerned with education. Lastly, he maintains that professional development activities can be delivered using technology. This could be (a) fully online, for accreditation as a professional teacher; (b) fully online courses for continuing education credits; (c) blended learning experiences that use online and face-to-face activities and webinars (Hodges, 2015:591; Hodges et al., 2016:2076).

Informal professional development involves activities that are constructed and adapted to meet the professional developmental needs of an individual (Hodges, 2015:592). According to Hodges (2015:592), this form of development has grown tremendously due to the Internet. Researchers argue that, incorporation of online services such as Twitter, Facebook, Google+, and mobile devices has enabled informal professional development to be more interactive and reflective (Hodges, 2015:592; Forte et al., 2012:106; Grant & Hsu, 2014:04). Web 2.0 tools have enabled online professional learning networks (PLNs) and community of practice (CoP). PLN consists of all the people who collaborate usually online with a purpose of developing each other. Teachers can use “e-mail and Web 2.0 tools such as blogs, wikis, Facebook, Twitter, LinkedIn, online collaboration tools” to create online PLNs (Anderson, 2010:107). Online PLNs and CoP, participants “begin with establishing norms and collaborative relationships; develop a shared understanding of the profession; and finally produce shared resources available to each member of the community” (Hodges, 2015:592).

CoPs are formed by people who belong in the same profession. These people interact and they share same interests (Anderson, 2010:108). Therefore a community of teachers who are coming together with a sole purpose to share best teaching approaches using ICT form CoPs (Anderson, 2010:109). According to Blitz (2013:01), CoPs can occur online when Web 2.0 tools are introduced. She argues that Web 2.0 tools add features such as interactivity and reflectivity. She further argues that when teachers engage in online CoPs, they interact with their peers better, gain a “sense of community”, and enhance their “pedagogical content knowledge (PCK)” which enable teachers to improve their teaching methods.

According to a study conducted by Msila (2015:1976), lack of training in ICT makes teachers reluctant to integrate ICTs in their teaching. Training of teachers takes place at high education institution and continues when they are employed. Training of teachers is done by higher education institutions because what needs to be taught in class and how it is to be done takes place at the institutions of higher learning (Adu et al., 2013:27). However, there are pre-service activities done by schools, for example when schools train prospective teachers. In-service training refers to teachers’ professional development.

Good professional development has the following elements:

- It ensures that teachers gain good leadership skills so that they can effectively assist new teachers and therefore become experts in their fields
- It ensures that teachers work together to solve problems and
- It ensures that teachers plan their development better. (Adu et al, 2013:26-27).

According to Adu et al. (2013:27), ICT can change how teachers are developed. Through ICT teachers can learn from one another, exchange best teaching approaches and be able to solve common problems. This means that teachers can gain new knowledge and skills from around the world which they can use to improve learner performances. Teachers who had initially received inadequate training can gain new and relevant skills through ICT. This is a mechanism of ensuring that content gaps are filled (Adu et al., 2013:27).

2 RESEARCH METHODOLOGY

In this research, the qualitative approach will be used in order to determine whether ICT act as an agent of change for teaching and teacher development using pattern matching.

In this research a case study will be used as a research design. Case study research design involves looking at a small group, project, institution or company (Saunders et al., 2009: 145). In this research a single institution (Mthunziwokolo secondary school) will be studied. Case studies are basically investigation of the factors that contributed to characteristics of the case under investigation. Saunders et al. (2009: 145), a case study is a strategy for doing research which involves an empirical
investigation of a particular contemporary phenomenon within its real life context using multiple sources of evidence. Therefore semi-structured interviews, focus group meetings and direct observations will be used to collect relevant data. The aim is to create a rich, textured description of social process. This will set a stage for more specific questions that might be asked later using more structured methods. The case study is useful because the study is dealing with the impact of the ICTs which is the how questions (Saunders et al.).

2.1 The participants
In this research a total of 23 teachers (later referred to as participants) were available to participate in the study.

It was not possible for all the participants to take part in this study because of time, money and access to the participants themselves (Yin, 2011:60). Therefore it was not possible to collect all the available data. A sampling strategy was therefore necessary (Saunders et al., 2009: 212).

3 RECOMMENDATIONS
Investment in educational technology requires good strategic management. Mthunziwoxolo needs to have a vision about its educational goals. The educational goals must be in line with the technological goals. Mthunziwoxolo need to integrate tablet use into teaching and learning.

4 CONCLUSION
ICTs have the potential of changing teaching and teacher development in rural schools so that ICT integration into teaching and learning is efficient, effective and responsive. Teachers need appropriate training in using ICTs as a pedagogical tool. Continued teacher professional development is important in capacitating teachers so that they can deliver quality education.

REFERENCES


