

ICTS FOR CURRICULUM DELIVERY: UNDERSTANDING EDUCATORS' PERCEPTIONS AND EXPERIENCES OF THE TECHNOLOGY IN DISADVANTAGED HIGH SCHOOLS

A. CHIGONA

ABSTRACT

The aim of this paper is to explore educators' perceptions on the use of Information Communication Technologies (ICTs) for curriculum delivery. Perceptions impact on the reality construction of the adoption and utilisation of the technology in disadvantaged schools. Understanding the perceptions of educators is vital when introducing innovation into curriculum delivery, because the way educators perceive the innovation impacts on the intended use of the technology in schools. Using the Interpretive Phenomenological Analysis (IPA) approach, the study conducted and analysed fifteen one-on-one interviews with purposively sampled educators on their perceptions of, and experience with, ICT in disadvantaged high schools. The results of the study show that some educators perceive themselves as not competent enough to use the technology. Others with relatively high computer self-efficacy reported to have experienced the use of the ICTs in classrooms as an add-on. Meta interpretation shows that besides the lack of motivation to integrate the technology into the classroom, the root cause of some educators' negative perceptions is the IT training they had, which was inadequate to equip them with pedagogical understanding and skills on how to effectively incorporate this technology into their curriculum delivery. Therefore, there is a need to realign ICT innovation and implementation with educators' perceptions, in order to ensure success.

Keywords: ICT, pedagogy, disadvantaged schools, educators' perceptions

INTRODUCTION

In South African schools, Information Communication Technologies (ICTs) are reshaping the curriculum delivery and administration in education. While some educators realise benefits of effective integration of ICTs in their curriculum delivery, many are not in a position to make informed judgments on the technologies to support their pedagogical goals. There is, nevertheless, a variety of factors that hinder adoption of ICTs by the educators. It is argued that, while ICT has provided new ways to teaching and learning processes, it has simultaneously "placed more demands on teachers to learn how to use these new technologies in their teaching" (Jung, 2005:94). This means that educators are expected to change their traditional ways of teaching if they are to use the technology effectively in their classrooms. But it should also be noted that teaching on its own is a complex activity "occurring in an ill-structured dynamic environment" and demanding many kinds of knowledge (Mishra & Koehler, 2006:1020). Nevertheless, research shows that the factors

that hinder ICTs adoption and use in pedagogy include educators' attitude, computer self-efficacy, knowledge and ability to evaluate the role of ICTs in teaching and learning, and lack of skills to be able to use the technology in classrooms (Sang, Valcke, van Braak & Tondeur, 2009; Lau & Sim, 2008).

In this paper, I am interested in analysing educators' perceptions on integrating ICTs into curriculum delivery within disadvantaged high schools under the Khanya Project in Cape Town.

The Khanya Project, an initiative of the Western Cape Education Department (WCED) in South Africa, aims to provide the technologies to schools and equip educators with ICT skills. According to the project, "By the start of the 2012 academic year, every educator in every school of the Western Cape will be empowered to use appropriate and available technology to deliver curriculum to each and every learner in the province" (Khanya Annual Report, 2008). Disadvantaged schools are of interest because research (Miller, Naidoo & van Belle, 2006) and recent anecdotal evidence show low adoption rates as well as low usage of the technology amongst educators in the Khanya schools. Hence it is necessary to investigate the reasons for low uptake and under utilisation of ICTs in pedagogy in the schools. Understanding the perceptions of educators is important, since the way educators perceive ICT can impact on the intended use of the technology in schools. Fullan (2001) argues that, for a change to take place in education, there is a need for educators to understand themselves, while other stakeholders must understand the educators' perceptions and experiences. Pucher (2010) stresses the need to use individuals' perceptions to realign ICT innovation with implementation. He says, "I monitor perceptions to ensure the success of goal-oriented, adaptive processes". Therefore, to achieve the desired outcomes of ICTs in schools, educators' perceptions about the technology and its implementation should be understood and addressed accordingly (Fullan, 2001).

This empirical study is focused and driven by the following questions:

- i) How do educators' perceive the use of ICTs in the curriculum delivery?
- ii) How do educators' perceptions impact on the integration of ICTs into their pedagogies?
- iii) What triggers the perceptions?

To answer these questions, I adopted an interpretive qualitative research approach to gather and analyse the one-on-one in-depth interviews with educators from disadvantaged high schools in Cape Town. I used an Interpretative Phenomenological Analysis (IPA) approach to gain insights into the way educators in the Khanya Schools perceive integration and use of ICTs for teaching and learning.

TECHNOLOGIES AND PEDAGOGY

Research shows that ICTs are increasingly considered significant in curriculum delivery and are reshaping traditional learning worldwide (Damoense, 2003:25). Various governments have invested hugely in ICT resources and training for educators in order to improve teaching and learning (Pelgrum & Anderson, 2001). The technologies provide new possibilities to teaching professions (Jung, 2005). Proper use of technology can effectively improve the curriculum delivery and learners' ability to understand lessons better, consequently increasing learners' performance (Wintz, 2009; Louw, Muller & Tredoux, 2008). It is argued that integration of ICTs in teaching and learning activities encourages constructive learning. As such, learners' thinking can be developed in a more efficient way than traditional teaching practices, i.e. learners develop skills such as reasoning, understanding and creativity (Higgins, 2003; Keong, Horani & Daniel, 2005). It is believed that capabilities such as comprehension and problem solving are better learnt using interactive media, hence necessitating the integration of ICTs into teaching and learning processes (Department of Education, 2004).

Research on the Khanya Project shows that one of the major impacts of introducing ICT resources into schools was the shift from the traditional 'talk and chalk' method of teaching towards a more interactive teaching style, where educators and learners positively interact throughout the learning process via the use of ICT resources (Chigona, Chigona & Davis, 2010). On specific subject, Earl (2002) shows that learners become motivated and improve their attitude towards science and their interest in learning when ICTs are integrated into the curriculum delivery. Further, Denby & Campbell (2005) also note that both teachers and learners were motivated when the technology was used in the science classroom, hence the process of teaching and learning was enhanced.

While there are many noticeable benefits of integrating ICTs into pedagogy, there are also challenges faced when using the technologies. According to Gips, DiMattia & Gips (2004), new technologies vis-à-vis the computer and its attached language learning programmes are likely to increase the individual school's budget, hence disadvantaged schools may not be able to afford the programs and expensive hardware and software. This may result in an increased digital divide between the schools in affluent areas and those in disadvantaged areas. In other words such costs "will cause unfair educational conditions for those poor schools and students" (Lai & Kritsonis, 2006:3). Another challenge with the technology is that, for learners to be able to use it for learning, they need to have basic skills on how to use the computers. This means that the learners who do not have prior experience with the technology are likely to lose out (Roblyer, 2003). For educators, effective use of the technology requires them to be trained on how to integrate the ICTs into their pedagogy. This training is to be done over and above their busy schedules (Jung, 2005).

FRAMEWORK: INTERPRETATIVE PHENOMENOLOGICAL ANALYSIS

This study employs an Interpretative Phenomenological Analysis (IPA) as a framework to understand how educators in the disadvantaged schools perceive integration and use of ICTs for curriculum delivery in their classrooms.

IPA is a qualitative research approach, and has its theoretical origins in phenomenology and hermeneutics. The framework was developed and described by Smith, Harre & Van Langenhove, (1995) and Smith, Jarman & Osborn, (1999). IPA is usually employed to explore how individuals make sense of their experiences. The approach is concerned with the experiences, events and actions held for individuals in the study (Chapman & Smith, 2002). The framework “can also be taken further to develop theories, models and explanations that help us understand human experience better” (Fade, 2004:647).

According to Smith et al (1999), the aim of IPA is to gain the participants' perspective of the phenomena being studied; at the same time the researcher is recognised to be the primary analytical instrument. The researcher's conceptions are valued for making sense of the experiences of the individuals being studied through a process of interpretative activity (Fade, 2004; Chapman & Smith, 2002). Thus, IPA is both phenomenological and interpretative. It is phenomenological because it “seeks an insider perspective on the lived experiences of individuals,” and is also interpretive because it “acknowledges the researcher's personal beliefs and standpoint and embraces the view that understanding requires interpretation” (Fade, 2004:648).

When using IPA, respondents are purposively included in the study i.e. only those who can offer meaningful perspectives on the phenomena being studied are approached to be respondents. Nevertheless, a homogenous sample is usually recommended. IPA uses data collection techniques such as focus group interviews and one-on-one interviews.

RESEARCH METHOD

This qualitative study employed IPA as a framework in trying to understand educators' perceptions and experiences about ICTs for curriculum delivery in disadvantaged high schools. Fifteen one-on-one semi-structured interviews were conducted with high school educators in disadvantaged high schools, in order to understand their perceptions and experiences about using ICTs for curriculum delivery. The educators were purposively sampled from three disadvantaged high schools in Cape Town. That is, educators who taught subjects which the schools considered more appropriate to integrate the technology when teaching the courses, were approached to participate in the study. All three schools were public, co-educational and located in the Metro

Central Education District within the Western Cape Education Department (WCED). The medium of instruction in the schools was English. Most of the learners in the schools came from underprivileged backgrounds. This had an implication on the use of the technology in the schools. Firstly, most learners had no prior ICT skills and therefore needed to be taught how to use the technology before they could use it for learning in the various subject areas. Secondly, the learners had no opportunity to practise with the technology outside of their allocated computer laboratory time.

In this study, as already indicated above, I wished to analyse in detail how educators in the previously disadvantaged schools perceive and make sense of their use of ICTs for curriculum delivery. I used a semi-structured interview schedule to engage in a flexible dialogue with the educators in the study. Interviews were tape-recorded with the consent of the participants, who were promised anonymity; the interviews were then transcribed verbatim. To establish trustworthiness of the findings, the interview transcripts were taken back to the respective respondents for feedback. Most participants made no changes to the transcripts, agreeing that that was exactly how they had responded to the questions asked. The others made a few syntactic changes to the interview transcripts.

After verifying the interview transcripts with the respondents, I did a detailed systematic qualitative analysis, case by case. I read and examined the first transcript repeatedly, each time annotating the text with initial comments. Then I extracted and listed the themes. The themes were then clustered in a meaningful way by looking for connections between them, in order to develop super ordinate themes.

However, since the study was done qualitatively, and due to the fact that data were collected from few individuals and were self-reported, the findings may not be generalised to a larger population.

RESULTS AND DISCUSSION

Using the IPA approach to analyse the data from the interviews, the following super ordinate themes were developed:

- Perception of the ICT training
- Perceived capability to use computers
- Computer in the classroom perceived as an add-on
- Lack of motivation to integrate ICTs into the classroom

PERCEPTION OF THE ICT TRAINING

Educators in the study were trained by Khanya on the basics of how to use computers in their schools. However, they perceived the training as inadequate for them to incorporate the technology into their classrooms.

Evaluating an educator's ICT training, Jegede (2009) recommended that computer training content should be more focused and educator targeted and not consist only of computer skills which have no impact on pedagogy. While the educators in this study could use the computers for administrative purposes, they lacked the pedagogical understanding and skills on how to incorporate the technology into their teaching. One educator, a deputy principal at his school, was comfortable to use the computer for administrative purposes, but could not use the technology for teaching his subject, Geography. He said:

"... I can use to teach Geography and make it more interesting and enjoyable by the learners, but unfortunately, I really don't know how to use it in class ... if someone could show me how to use it I would be very happy."

While schools in affluent areas can afford to organise training to equip the educators with Technological Pedagogical Content Knowledge (TPCK) which enables them to effectively use the ICTs in their classrooms, those in the disadvantaged areas cannot. The parents and learners are economically poor. The educators too cannot afford to pay for their own professional development. They also cannot afford a computer at home, so they cannot try things and self train when at home. One educator commented that:

"You know in [former] Model C schools, the schools have resources to pay people who can show them how to use the computers in teaching and also can afford to employ people to support the teachers whenever they have a problem with the computers ... but here depending only on the Khanya we cannot do much."

Nevertheless, Niess (2006:196) is of the opinion that "for technology to become an integral component or tool for learning the subject, teachers must also develop an overarching conception of their subject matter with respect to technology and what it means to teach with technology technology pedagogical content knowledge". In addition, Carter & Monaco (1987) posit that the ability to use the technologies effectively goes much further than basic skills of keyboard and mouse operations; one needs to have knowledge about the relevance, value and impact of information.

Integration of ICTs in curriculum delivery is complex. The pedagogy of the educator is critical in shaping the technology-learning opportunities in classrooms. Some researchers have expressed concern that most educators more and more believe that it is becoming increasingly difficult for them to improve teaching strategies without improving their knowledge of content and technological skills (Carnoy, 2004). This perception is common among educators in disadvantaged communities where there are large numbers of under-qualified teachers (van der Berg, 2008). Therefore, it may be an insult to provide ICT training which is inadequate and does not focus on

the pedagogy of the educators who are already struggling to get to terms with simply the content.

PERCEIVED CAPABILITY TO USE COMPUTERS

Educators in the study reported different perceptions about their ability to use ICTs in their classrooms. The perceptions regarding the use of the technologies could be linked to the educators' computer self-efficacy. Self-efficacy is the belief one has about him/herself to perform a specific task (Bandura, 1997). *Computer self-efficacy* "... refers to a judgment of one's capability to use a computer" (Compeau & Higgins, 1995:192). According to Karsten & Roth (1998:62), "Computer self-efficacy is positively correlated with an individual's willingness to choose and participate in computer-related activities, expectations of success in such activities, and persistence or effective coping behaviors when faced with computer-related difficulties". One educator stated that new technology is:

"Only for those who want it, but there are those who actually don't! Some teachers who actually says, 'I've always done it this way, I will always do it that way' ... you will always have those teachers ..."

Many of the teachers here have taught many years and see themselves as being part of the "typewriter age" and are more comfortable with that than with the computer ..."

While some of educators in the study perceived ICTs as tools that could make their pedagogy easier and more interesting, others still perceived the introduction of the technology as a threat and did not see the actual benefit of using it in their teaching and learning. The others were afraid that the technology might replace the role of the educators in the schools. One respondent, who is also the head of ICT in his school, narrated that:

"When computers were being first introduced at this school, the first response was, we will not be able to do this, no, this is too big for us, we're not going to be able to manage, but also teachers were afraid that the technology was going to take over their jobs ... we still have some who still think like that and are not keen to use the computers at school."

One educator who perceived the integration of ICT in curriculum delivery as not really being beneficial said:

"I teach Maths ... I don't use the server ... I have my handouts and I give them instructions and they follow those instructions ... I explain, you know, but they [the learners] seem to cope with that very well."

It was interesting to note that even after receiving IT training, this educator still resisted the use of computers for teaching the subject Maths (which her school

recognises as one of the subjects prioritised to benefit from the computer laboratory at the school). When probed further, she indicated that she does not feel competent enough to use the computer in class, because there are some learners who understand the technology more than she does, and so would be embarrassed if she made a silly technological mistake in front of the class. Similarly, Compeau & Higgins (1995) found that individuals with higher self-efficacy beliefs used computers more often and experienced less computer-related anxiety.

COMPUTER IN THE CLASSROOM PERCEIVED AS AN ADD-ON

Most of the learners in the sample schools came from low socio-economic backgrounds, hence most of these learners did not have access to computers at home. The learners only started to use computers for the first time at high school. When the technologies were being introduced in the schools, Khanya had trained educators only, not learners, on how to use the computers. From that point, the educators were expected to use the technologies for curriculum delivery. The learners' lack of ICT knowledge frustrated some educators when using the technology for teaching and learning. One educator said:

"When sometime I plan to take my class to the computer laboratory for a lesson, it is so frustrating because I spend most of the time showing the learner how to use the computer instead of concentrating on the subject content."

Some educators perceived ICT in their schools as an add-on and not as a tool which could make teaching and learning easier and more interesting. Due to the low computer literacy levels of the learners, the educators had to, most of the time, be concerned with teaching the technology instead of teaching with it. This problem was exacerbated by too few computers in the school laboratory; the school laboratory also could not accommodate the high numbers of learners per class in the school. Unfortunately, the schools cannot afford to buy more computers because they are economically stretched. One educator complained that:

"The computers in the laboratory are not enough for our big classes, so when teaching, a number of learners sit on one computer, which makes it hard to teach them how to use the machines ... to make things worse, they don't have computers at home so that they could at least have a chance to get acquainted to computers; our lab is also closed after school. So it is really hard for both the teachers and the learners."

These findings are in line with existing literature which shows that limited numbers of computers in institutions of learning, as well as high numbers of learners per class, are some of the barriers to the successful use of the technology for teaching and learning (Al-Otaibi, 2006).

LACK OF MOTIVATION TO INTEGRATE ICTS INTO THE CLASSROOM

The analysis of the interviews shows that the learners' low computer literacy has impacted on educators' motivation to use the computers for teaching and learning. This situation is exacerbated by the fact that the schools in the disadvantaged communities, unlike those in affluent areas in Cape Town, cannot afford effective technical support structures within the institutions. Consequently, most educators in the disadvantaged schools do not feel motivated to use the computers available in their institutions for teaching. On the issue of taking learners who are not computer literate to the school laboratory one educator said,

"You know working with kids who do not know very well to use computers, things go wrong and if you don't have someone around to help fixing is not nice, so you think twice before you take your class to the computer lab."

Another Mathematics educator, complaining about unavailability of technical support, said:

"The fact that there's no specific person I can go to when I get stuck and I need certain questions to be answered, de-motivates me to use the lab ... The other problem is that ... very often the lab is out of bounds because things have gone wrong and they just cannot manage the lab or sustain it properly because technically things go wrong and things are out of bounds, you know that I find very frustrating."

It has also been argued that institutional factors play a big role in the acceptance and use of ICTs. Staff members feel constrained by a lack of institutional support and vision. Many feel unsure of the direction they should take and the purpose that the ICTs are meant to serve. Lundall & Howell (2000) concluded that lack of support is one of the big contributing factors to under-utilisation of computers for curriculum delivery in schools.

CONCLUSIONS

The analysis has shown that educators in the study have different perceptions about the integration of ICTs into pedagogy. While some perceived the use of ICTs for teaching and learning to be relevant and beneficial, others feel threatened by the technology, or fail to see the actual benefit of incorporating the technology into their pedagogy. The latter group perceived the technology as confusing and as a tool which could replace the role of educators in pedagogy.

Meta interpretation of the results shows that the root of some educators' negative perceptions is the Information Technology (IT) training they had had, which was not adequate to equip them with pedagogical understanding and

skills on how to effectively incorporate ICTs into their work. Firstly, many educators in the disadvantaged areas are under-qualified (van der Berg, 2008) which means that for them to teach even without new technology is not easy, because they do not have pedagogical content knowledge which teacher education should equip educators with when they go for their teacher training. Now inadequate IT training just ends up confusing the under-qualified teacher, hence leading him/her to:

- (i) feel worthless because he/she cannot use the technology as expected,
- (ii) to hate the technology because it is not helping to improve his/her teaching - if anything, it is just complicating his/her work.

Secondly, since the schools in the disadvantaged areas are poor and so cannot afford enough equipment for their big classes, it becomes difficult for some educators (i.e. those who at least feel confident to teach with computers) to handle the classes when trying to use the technology for curriculum delivery. The situation is made worse by the fact that their learners do not have the basic skills to use the computers in the classroom. Unfortunately, the educators themselves do not have the capability to guide the learners in exploring the computers. Lai & Kritsonis (2006) also show that “most teachers today do not have sufficient technological training to guide their students in exploring the computer and its assisted ... learning programs.”

In a nutshell, it may be argued that, for effective integration of ICTs into classrooms in disadvantaged schools such as those in this study, there is need for:

- (i) professional development programs where educators lacking capabilities to use technology in their classrooms could be shown and learn to develop a conception of their teaching subjects with respect to ICT and what it means to teach with the technology;
- (ii) learners should be equipped with skills they require to be able to use the computers in their classrooms for learning; and
- (iii) school management should encourage and motivate all educators to use the technologies available in their institutions. This could, among other things, bring uniformity to all learners at the same level regardless of which teachers are teaching them.

ACKNOWLEDGEMENT

This article is a revised version of the paper presented in April, 2010, *Conference for Policy Research Africa - CPR Africa* at the University of Cape Town. I would like to thank Wallace Chigona, with whom I prepared the conference presentation, for his contribution to the study.

REFERENCES

- Al-Otaibi, N. 2006. E-learning impediments in the Kingdom of Saudi Arabia. Mutah University. Available at <http://www.alriyadh.com/2006/12/18/article210141.html>
- Bandura, A. 1997. *Self-efficacy: The exercise of control*. New York: W.H. Freeman & Company.
- Carter, C. & Monaco, J. 1987. *Learning information technology skills*. Library and Information Research Report 54. London: The British Library.
- Carnoy, M. 2004. ICT in Education: Possibilities and challenges. Inaugural Lecture of the UOC 2004-2005 Academic year. 2004: Barcelona. Available at: <http://www.ouc.edu/inaugural04/dt/eng0carnoy1004.pdf>
- Chapman, E. and Smith, J.A. 2002 Interpretative Phenomenological Analysis and the New Genetics. *Journal of Health Psychology*, Vol. 7, No. 2, pp. 125-130.
- Chapman, D. W., Mahlk, L. O., (eds), 2004. *Adapting technology for school improvement: a global perspective*. Paris: UNESCO and International Institute for Educational Planning.
- Chigona, A. Chigona, W. & Davis, Z. (2010): Motivating factors: Educators' use of ICT in schools in disadvantaged areas in the Western Cape. *Proceedings of International Conference on Information Management and Evaluation*, University of Cape Town, 25th - 26th March 2010.
- Compeau, D.R. & Higgins, C.A. 1995. Computer self-efficacy: Development of a measure and initial test. *MIS Quarterly*, June, pp. 189-211.
- Damoense, M.Y. 2003. Online learning: Implications for effective learning for higher education in South Africa. *Australian Journal of Educational Technology* 19(1), pp. 25-45.
- Denby, D. & Campbell, B. 2005. *ICT in support of science education: A practical user's guide*. Available at: <http://www.leggott.ac.uk/pdfs/awards/ICTinsupport.pdf>
- Department of Education. 2004. White paper on e-Education. Government Gazette (Vol 470, No 26734).
- Earl, K. 2002. *Curriculum innovation in a New Zealand secondary school: Identification of enablers and inhibitors*. Unpublished MEd thesis, University of Waikato, Hamilton, New Zealand.
- Fullan, M.G. 2001. *The New Meaning of Educational Change*. 3rd edition. London: Teachers College Press.

Fade, S. 2004. Using interpretative phenomenological analysis for public health nutrition and dietetic research: a practical guide. *Proceedings of the Nutrition Society*. 63, pp. 647-653.

Gips, A., DiMattia, P. & Gips, J. 2004. The effect of assistive technology on educational costs: Two case studies. In K. Miesenberger, J. Klaus, W. Zagler, D. Burger (eds.), *Computers Helping People with Special Needs*, Springer, 2004, pp. 206-213.

Higgins, S. 2003. Does ICT Improve Learning And Teaching In Schools? A Professional user review of UK research undertaken for the British Educational Research Association. Southwell, Notts.: BERA.

Jegede, P.O. 2009. Assessment of Nigerian educators' ICT training. *Issues in Informing Science and Information Technology* 6, pp. 415-420.

Jung, I. 2005. ICT-Pedagogy Integration in Teacher Training: Application Cases Worldwide. *Educational Technology and Society*, 8(2), pp. 94-101.

Keong, C.C., Horani, S. & Daniel, J. 2005. A Study on the Use of ICT in Mathematics Teaching. *Malaysian Online Journal of Instructional Technology*, 2(3), pp. 43-51.

Karsten, R. & Roth, R.M. 1998. Computer Self-Efficacy: A Practical Indicator of Student Computer Competency in Introductory IS Courses. *Informing Science* Vol. 1(3), pp. 61-68.

Khanya Annual Report. 2008. Khanya Annual Report for the period March 2007 to April 2008. Available at www.khanya.co.za/projectinfo/docs/khanya_annual_rep_2008.pdf

Lau B.T. & Sim, C.H. 2008. Exploring the extent of ICT adoption among secondary school teachers in Malaysia. *International Journal of Computing and IT Research*, Vol. 2 (2) 19-36

Lai, C. & Kritsonis, W.A. 2006. The Advantages and Disadvantages of Computer Technology in Second Language Acquisition. *Doctoral Forum National Journal for Publishing and Mentoring Doctoral Student Research* 3(1), pp. 1-6.

Lundall, P. & Howell, C. 2000. Computers in schools: A national survey of Information Communication Technology in South African schools. Cape Town. Education Policy Unit: University of the Western Cape.

Louw, J. Muller, J. & Tredoux, C. 2008. Time-on-task, technology and mathematics achievement. *Evaluation and Program Planning* 31 pp. 4150.

Miller, L., Naidoo, M., van Belle & J.P. 2006. School-level ICT Adoption Factors in the Western Cape Schools. *Fourth IEEE International Workshop On Technology for Education in Developing Countries* pp. 57-61.

Mishra P.& Koehler M.J. 2006. Technological Pedagogical Content Knowledge: A Framework for Teacher Knowledge *Teachers College Record* Vol. 108, No. 6, pp. 1017-1054.

Niess, M. L. 2006. Guest Editorial: Preparing teachers to teach mathematics with technology. *Contemporary Issues in Technology and Teacher Education*, 6(2), pp. 195-203.

Pelgrum, W.J. & Anderson, R.E. 2001. *ICT and the emerging paradigm for lifelong learning*. Second edition. Amsterdam: IEA, University of Twente

Pucher, M.J. 2010. Perceptions are Reality. Available at <http://isismjpucher.wordpress.com/2010/09/26/perceptions-are-reality/>

Roblyer, M. 2003. *Integrating educational technology into teaching*. Columbus, Ohio: Person Education.

Sang, G. Valcke, M. van Braak, J & Tondeur, J. 2009. Student teachers' thinking processes and ICT integration: Predictors of prospective teaching behaviors with educational technology. *Computers & Education Journal* Available at <http://www.elsevier.com/locate/compedu>

Smith J.A., Harre, R. & Van Langenhove, L. (editors) 1995. Ideography and the case study. In *Rethinking Psychology*, pp. 59-69. London: Sage Publications.

Smith J.A., Jarman, M. & Osborn, M. 1999. Doing interpretative phenomenological analysis. In *Qualitative Health Psychology: Theories and Methods*, pp. 218-240 [M Murray and K Chamberlain, editors]. London: Sage Publications.

van der Berg, S. 2008. "How effective are poor schools? Poverty and educational outcomes in South Africa". Discussion paper for the Center for European, Governance and Economic Development Research. Paper number 69, January 2008.

Wintz, P. 2009. Making quality education accessible to all through technology: A case study on accelerating quality delivery of the mathematics curriculum by re-tooling mathematics classrooms with only one computer, *International Journal of Education and Development using Information and Communication Technology* Vol. 5, Issue 3.