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THE PEDAGOGICAL INTEGRATION OF ICTs BY SEVEN SOUTH AFRICAN TOWNSHIP SECONDARY SCHOOL TEACHERS

A thesis submitted in fulfilment of the requirements of the degree of

DOCTOR OF PHILOSOPHY

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THE UNIVERSITY OF THE WITWATERSRAND

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Abstract

The issue of best practice in the pedagogical integration of ICTs into subject teaching has been debated internationally with the aim to offer guidance to teachers on how to effectively utilise these digital tools in the classroom. The resultant literature has reported that teachers in schools with fewer resources integrate ICTs at a lower level. South African township schools fall under this category. In an attempt to bridge this divide, these schools have received digital technologies from the government and other sponsors. In addition, teachers have been trained on ICT basic skills as preparation for use of technology in their classrooms. However, studies carried out to assess the effectiveness of these interventions have resulted in the call by the South African government for solutions that 'work'. It is increasingly apparent that more than just digital resources are required if ICT integration is to be achieved.

This study investigates selected seven South African township secondary school teachers' practices and education policies to understand what is of pedagogical value in the use of ICTs for teaching. The findings are employed to develop an ICT teacher training framework that can help teachers in this country to maximise the utilisation of the digital technologies they have in their schools.

A multi-case study is employed in which teacher interviews and lesson observations of participating teachers from a district in the Gauteng Province in South Africa are interpreted. Thereafter, a document analysis of four South African education policies is used to form a policy framework that is employed to assess teacher practice compliance to the country's education context. This is done to customise findings to the South African education setting to facilitate the development of a relevant ICT teacher training framework.

Diana Laurillard's Conversational Framework is adopted as the theory that helps make explicit the teachers' espoused and enacted practices. Her description of media forms is interacted with Grainne Conole and Martin Dyke's conception of ICT affordances to help identify the pedagogical value in the teachers' practices with ICTs. The results reveal how teacher beliefs, experience, subject needs, as well as learner needs, play a substantial role in determining the value ICTs bring to the teaching and learning experience. The significance of these characteristics demonstrates and accentuates the role of the teacher as a mediator in making ICTs of pedagogical value in the classroom.

Key Words: ICT Pedagogical Integration, Conversational Framework, Media forms, ICT affordances

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Dedication

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Declaration

I declare that this is my own unaided work. It is submitted for the Doctor of Philosophy at the University of the Witwatersrand, Johannesburg. It has not been submitted before for any degree or examination at any other university.

Nokulunga Sithabile Ndlovu

……..

3rd day of August, 2015

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List of Acronyms

ANA	Annual National Assessment
CAPS	Curriculum Assessment Policy Statement
CD	Compact Disc
CD-ROM	Compact Disc, Read Only Memory
CF	Conversational Framework
DFAQ	Dynamic Frequently Asked Questions
DVD	Digital Video Desk
FAL	First Additional Language
FET	Further Education and Training (grade 10 to 12)
GDE	Gauteng Department of Education
GoL	Gauteng on Line
HoD	Head of Department
HOTS	Higher Order Thinking Skills
ICT4D	Information and Communication for Development
ICTs	Information and Communications Technologies
IQ	Intelligence Quotient
LoLT	Language of Learning and Teaching
MCQ	Multiple Choice Questions
NCS	National Curriculum Statement
PanAf	Pan African Research Agenda for the Pedagogical Integration of ICTs
PBL	Problem Based Learning
PCK	Pedagogical Content Knowledge
PIRLS	Progress in International Reading Literacy Study
PTD	Professional Teacher Development
SITA	State Information Technology Agency
TIMSS	Trends in International Mathematics and Science Study
TPCK	Technological Pedagogical Content Knowledge
Wi-Fi	Local area wireless computer networking
ZPD	Zone of Proximal Development
IT	Information Technology
GIS	Geographic Information System

Definition of Key Terms

ICT pedagogical integration – the infusion of digital technology affordances into teaching and learning with the guidance of the teacher[1].

ICT pedagogical value – the significance of the use of ICTs to enhance learning[2].

Enhancement of learning – enriched teaching experience that promotes learning.

Media – tool or mode used to convey content in the context of this study[3].

Media forms – categorisation of media by Laurillard[4].

ICT Affordance – the perceived and real capability of an ICT[5]

Espoused practice – teacher beliefs and attitudes[6]

Enacted practice – teacher actual teaching[7]

[1] See Chapter 2 and 8 for a detailed description
[2] See Chapter 2 for a detailed description
[3] Media can be any tool, digital or non-digital. ICTs are the media that this study focuses on.
[4] See Chapter 2 for a detailed account of media forms
[5] Hammond (2010)
[6] In this study, these are expressed during teacher interviews
[7] In this study, these were the actual teaching of lessons observed

Chapter 1

Introduction

The influx of Information and Communication Technologies (ICTs) into the field of education with its promises to transform and advance the classroom experience has led many departments to invest in them with the hope that they will solve teaching and learning challenges. Subsequently, debates in this field of ICT in education have tried to grapple with how these digital technologies are and should be effectively used in the classroom beyond the rhetoric about them. The fact that the rhetoric is not only found in academic literature, but in education policies which act as guides in their use make their interpretations by teachers critical to the successful and intended use of these digital tools. The challenge that teachers face is that the discourse does not overtly disclose how ICT affordances should be used to bring value to the teaching and learning experience.

A number of studies carried out globally have distinguished the use of digital technologies from the learning objective in their descriptions and have therefore offered interpretations of the concept that have prompted authors like Soule (2003), Oppenheimer (1997) and Clark (1994) to launch arguments against implementation that seems not to measure up to the pedagogical value that ICT integration is alleged to bring.

Some of these studies have identified ‘motivating learners to learn’ as one of the benefits of using ICTs in the classroom. In that case, Soule (2003) argues that while learners may be motivated, that does not mean they learn better because there is ICT. This therefore demands a closer look at how specifically this motivation enables ‘learners to learn’ as Laurillard (2012) suggests in her description of what teaching is.

Furthermore, ICT pedagogical integration is valued for giving access to more information (Reid, 2002). If that hypothesis holds, what evidence can we as educators present that learners have learnt, unless we consider their minds to be sponges or “collectors and consumers of information” (Loveless, De Voogd and Bohlin, 2001) that naturally draw from these instantaneous sources. Oppenheimer (1997) contends that what learners do with it (information) is what schooling should be concerned about.

The linear use of digital technologies and their conceptualisation as an isolated feature in the teaching and learning process has made them appear as "mere vehicles that deliver instruction" (Clark, 1983:445). This type of ICT use subverts the potential its affordances have to create rich learning environments which McLuhan and Fiore cited in Lloyd (2005:5) asserts are "not passive wrappings, but are, rather, active processes that are invisible". These views suggest critical consideration for the approach to the
implementation of ICT pedagogical integration if their use is to be of value to the teaching practice.

In order to understand how a productive integration process can be achieved, this study interprets selected teacher practices. It is a response to the discovery that teachers in township secondary schools participating in a South African study carried out by the PanAfrican Research Agenda on the Pedagogical Integration of ICTs in the database online www.observatoiretic.org (2009-2012) were not integrating ICTs into their subject teaching to the extent that there is pedagogical value (as stipulated in the policy) in their usage, despite attending ICT teacher training programmes and having the technologies at their disposal. The Second International Information Technology in Education Study of (SITES) 2006 cited in Cassim (2010) and Draper (2010) confirmed that South African teachers who now have access to ICTs either in the computer laboratories or classrooms are faced with the challenge of pedagogically integrating these digital devices into subject teaching to enhance learners' performance. In addition to this challenge is the issue of infrastructure, inadequate access to digital resources, lack of technical and school leadership support and electricity in some cases (Bingimlas, 2009). These and many other barriers to the successful implementation of ICT pedagogical integration have seemingly blocked chances of teachers in developing countries like South Africa from effectively participating in this transformation. Contrary to that, the seven township secondary school teachers in this study claim that their use of ICTs in their classrooms has pedagogical value despite them facing similar obstacles.

This study argues that effective usage of ICTs does not depend on the above factors that Ertmer et al. (2012) refers to as external, but on the teacher's pedagogical beliefs about their subject teaching, learner needs and perceptions about ICT affordances (Hammond, 2009) that eventually influence the actual teaching regardless the presence of the barriers at any level within and without the institution they work from. It is for that reason that this study is engaging Laurillard's Conversational Framework to try and demonstrate the significance of the role of the teacher (through classroom dialogue) in the integration of digital resources to enhance or 'accelerate' learner understanding of their subject concepts. It is through this investigation that the role and value of ICT integration into classroom dialogue is exposed.

The purpose of this chapter is to provide an overview of the South African ICT in education studies that have been carried out in this field to provide a background for this study. It will also present the aim and the research questions. The chapter concludes by giving a summary of the thesis chapters.

Background

In order to appreciate ICT in education in the context of this country, an understanding of the authorizing policy is necessary. The South African ICT in education policy (White Paper on e-Education) presents specific indicators that validate the outcomes of an effective implementation of ICT pedagogical integration into subject teaching. It states, "e-Education is more than developing computer literacy and the skills necessary to operate various types of information and communication technologies. It is the ability to:

- apply ICT skills to access, analyse, evaluate, integrate, present and communicate information;
- create knowledge and new information by adapting, applying, designing, inventing and authoring information; and
- function in a knowledge society by using appropriate technology and mastering communication and collaboration skills."

  White Paper on e-Education, (Department of Education, 2004:14)

These abilities seem to form the core of what the national policy, the Curriculum Assessment Policy Statement (CAPS) envisages for every learner that passes through the South African education system, and computers are believed to accelerate the achievement of its outcomes (DoE, 2004).

The government strategy to ensure the achievement of the goals advocated for in the White Paper on e- Education proposed three phases for the execution of its policy implementation plan which were:

Phase 1: Enhance system-wide and instructional readiness to use ICTs for learning, teaching and administration (2004-2007).

Phase 2: System-wide integration of ICTs into teaching and learning (2007-2010).

Phase 3: Integration of ICTs at all levels of the education system, including management, teaching and learning, and administration (2010-2013).

The South African government has managed through ICT projects like Gauteng on Line in Gauteng and Khanya Project in the Western Cape Province to work towards accomplishing these phases by providing schools with infrastructure, digital equipment and preparing teachers for ICT use in the classroom. However, Chikasha et al. (2014:138) note, "While schools are increasingly gaining access to ICT-related infrastructure, most teachers are still not integrating these technologies into their teaching" in the Gauteng Province. Although Chigona & Chigona (2010) commend the impact of the Khanya project, they reveal that many teachers teaching in disadvantaged schools in the Western Cape Province are still not using ICTs for teaching and learning.

Vandeyar (2015) associates this low uptake to the absence of a guiding policy on how to implement the ICT in education policy and the lack of policy and district support. Although he (2015) argues that successful implementation of ICT integration is yet to happen, based on this study, the execution is occurring, but is rather sporadic and sparsely spaced. In addition, Vandeyar (2015) reveals that the ICT in education policy has not been communicated to all schools in his study and that ICT integration has not been driven by the e-Education mandates, but rather by teachers' professionalism. This finding could be the reason why most teachers' practices in this study are not aligned to the policy (See Chapter 7). Vandeyar (2015) proposes that future research investigates the influence of e-Education on teaching and learning in schools.

While teachers might not be influenced by policy implementation, advocates for ICT4D, Fengu and Krauss (2012:1) express the need to develop an ICT teacher training framework that "inspire, motivate and empower them to take ownership of their own setting and position in society without re-enforcing a repressive situation or disrupting the local community fibre". The fact that currently the policies do not give explicit guidance (See Chapter 6) on the form of ICT usage in their specific teaching activities seems to have worked to the participating teachers' advantage as it has left the influence of technology to their discretion and this could be the reason for the diversity in the teachers' integration styles.

Although there is evidence that poor policy implementation caused by lack of explicit guidance contributes to the low pedagogical integration of ICTs, there are other factors that emerge in some of South African studies. For instance, findings from the Pan African Agenda on the Pedagogical Integration of ICTs (2009 - 2012) and other studies like that carried out by, Czerniewicz & Brown, (2005) seem to suggest that socio-economic status of such schools could be a drawback in the implementation of ICT integration. However perceptions like these imply that external issues have a

strong influence on the integration process and tend to isolate digital technology from actual teaching which is immaterial in the context of classrooms of teachers participating in this study. Nevertheless, details of the PanAfrican study that prompted this investigation are provided below.

The PanAfrican Agenda on the Pedagogical Integration of ICTs

The author of this thesis participated in the above project sponsored by Information Development (Info Dev) and the United Nations Educational Scientific and Cultural Organisation (UNESCO) as a researcher. The purpose of the venture was to provide African researchers, educators, policy decision makers and development practitioners with an open access database they could use to make informed resolutions by reporting in its findings, "what is being done in schools with ICTs and how they are contributing to the quality of teaching and learning" (www.observatoiretic.org). Researchers from ten African countries participated in the study and each was required to select ten institutions representing diversity in the education system that would represent their demographic distribution. Some of the key themes covered in the 7 main indicators that are relevant to this study are, ICT use by teachers, its impact and sustainability.

As the local research station, Wits School of Education in the University of the Witwatersrand selected ten South African schools in the Gauteng province with the university being the eleventh institution to participate in the study. The five secondary schools in the study are all public schools. Although teachers in these schools have been trained to use ICTs, only 14% of the subjects were taught with digital technology. One of the secondary schools was located in a suburban community and the integration levels in all subjects were higher than those of the other four schools. The researcher was particularly interested in these four secondary schools located in the townships whose levels of ICT pedagogical integration were lower despite teachers having ICTs in their schools and having been trained by government training agencies in basic computer skills. The teachers reported that the training offered did not prepare them to teach their subjects with computers. It became evident that there was a need for an ICT teacher training model that would equip teachers, particularly in schools with limited digital resources with expertise they needed to use these machines in their classrooms to the extent that they bring value equivalent to that stated in the South African ICT in Education policy advocates.

Findings in the PanAfrican study were based on teacher responses to interviews and did not enter into the classrooms to find out how teacher espoused practices and the educational context could have contributed to their enacted practices. This is necessary in identifying what it is that ICT

teacher training should focus on if teachers would benefit from the ICT affordances of the limited technologies they have at their disposal. This multi-case study is an attempt to address this gap. It has been carried out in a district that is in the same province (Gauteng) as that of the PanAfrican study and is aimed at understanding how teachers with limited resources integrate ICTs effectively. Its intention is to use the findings to develop an ICT teacher training programme for South African teachers. The next section presents documented studies from some of South African provinces that highlight the outcomes of studies related to ICT pedagogical integration into subject teaching.

South African studies on teacher use of ICTs

The investigations that follow have been driven by the quest to understand the extent to which teachers use ICTs for teaching and learning in schools that have these digital technologies. Some have sought to understand factors that seem to hinder effective ICT integration in South African schools.

Based on the history of the South African Education system, the apartheid regime left a legacy of unequal distribution of resources that has proved to be difficult to redress by just donating resources to schools. The following studies disclose some of the repercussions of this legacy.

In 1998 a survey to look at the nature of ICTs in South African schools was undertaken by Lundal and Howel (2000) from the Education Policy Unit in the University of the Western Cape. The aim was to investigate to what extent schools were integrating ICTs and to identify factors that contributed to the implementation. Amongst a number of findings related to ICT integration, the researchers concluded that schools with better or more advanced digital equipment had a higher inclination to effectively use ICTs for teaching and learning. In their argument for effectiveness in the use of ICTs, Bialobrzeska and Cohen (2005:13) stress, "however good the ICT infrastructure in a school may be and however wide the range of software the school has, these are only as good as the teacher using them". Teaching expertise revolves around understanding learning and how to mediate it (Laurillard, 2002 and Bialobrzeska and Cohen: 2005). The learning outcome the teacher is working towards therefore becomes central to the success of the process. It is not really much of the technology as Bialobrzeska and Cohen (2005) assert, but how the actual teaching (good or bad) is enhanced by its use. What enriches the use is the "shift from a single authoritative textbook to the use of a range of resources" (2005:13). Multimedia, an ICT affordance can be used to create authentic problems to enrich learning environments for example.

Later in their report, these researchers rate ICT integration based on learner levels of engagement and evaluate it as low (for drill activities) and high (for problem solving, project work and presentations). Although findings by Schoepp (2005) and Becta (2004) allude to that of Lundal and Howel's (2000) study in the sense that they relate limited resources to ineffective or adoption of resources, this study finds these findings daunting. Bialobrzeska and Cohen (2005) in their book support this study's position in their discussion that demonstrates how teachers with limited resources can make the best of the benefit of ICTs in their classrooms. They disagree with views that suggest, the fewer the resources, the less competent teachers become in their use of computers to perform their teaching duties. Data projectors can be used by the teacher as a valuable tool to project chunks of concepts or structure, out-of-reach occurrences and this technology gives all learners access to content at the same time (Bialobrzeska and Cohen:2005) and facilitates an understanding of complex subject matter.

Although the affordances from the computers they use might be limited, "there are alternatives for use within each set of constraints, and possibilities for managing the resources in different ways" Bialobrzeska and Cohen (2005:10). That becomes possible if usage is driven by a motive to address diverse classroom teaching and learning needs and if the teaching strategy used is already effective. Findings from Chikasha et al. (2013) support this view in the sense that teachers who believed ICTs had a potential to enhance teaching and learning of their subjects were more likely to integrate ICTs. The president of Intel concurred with this study by arguing that computers are not magical but teachers are (Barret, 2000). His view highlights the responsibility and credibility of the impact of the teacher in the use of ICTs.

On the other hand, Wilson-Strydom and Thomson (2005:9) and Lundal and Howel (2000) agree on the notion that the length of time schools have with computers has an impact on the extent to which they are used for enhancing teaching and learning. This study argues that the teacher's belief or perception about ICTs and their value in the teaching and learning process have a bigger impact on the value of their usage. In this study for instance, the teacher who had more years (five) using the computer for teaching and learning did not use them to the extent that the one in a school with two years did.

Another study was carried out by Ng'ambi and Johnston (2006) in the University of Cape Town (UCT) on the impact of a learning support instrument, the Dynamic Frequently Asked Questions (DFAQ) tool. Students anonymously asked and answered questions online on their course to develop their critical thinking skills. The results of this endeavour were unexpected, as the

researchers anticipated the skills developed through the use of the tool would improve learner examination performance as well. The results were as follows:

Table: 1.1 Ng'ambi and Johnston Course Assessment

Course Assessment	2003	2004
Essays and assessment	10%	16%
Workshop exercises	10%	10%
April Test	20%	10%
Class participation and questioning	0%	4%
Final Examination	60%	60%

Ng'ambi, D., & Johnston, K. (2006).

The results above display an improvement in their coursework marks, a decline in the formative test and no improvement in their examination performance. The reason the researchers gave was that there was a possibility that their study did not focus on improving performance in the examination but to increase learner support and to increase motivation, based on the outcome. In other words, the engagement of this single technology as a medium of learning did not match the main learning goal or outcome. It is also possible that concentrating on questions and answers as the main pedagogical strategy could have been the weakness. The other reason could have been the type and purpose of questions asked. If, for instance, they focused on the content covered without giving them an opportunity to focus on larger parts (Anderson, 1970; Hudgins, 1977) that are included in the exam, the purpose for using the software would be unlikely to be achieved. All these variables emphasise the complexity of the amalgamation of pedagogical components that contribute to making learning possible which if ignored, the use of ICTs fails to play its role in enhancing learning.

In his promotion of indigenous languages, particularly in township schools, Gudmundsdottir (2010) sought to demonstrate inequalities brought about by the English language used in computers. His study revealed that although the participating learners were not comfortable with the use of English in the classroom or on computers, they supported its use by attaching value to it as an important language. However, passivity and teacher centeredness are reported as disadvantages for using the language in those platforms. The fulfilment of this claim depends on the teacher presenting the material. An effective teacher with learners whose mother tongue is not the Language of Learning and Teaching (LoLT) is able to come up with teaching strategies that would curb learner language barrier through the use of ICTs. Technology is a tool that can be manipulated to cater for cultural and educational demands. The Ghanaian scholar, Gyekye (1997:37) argues that as a cultural product, technology "should rise from the culture of people, if it is to be directly accessible to a

large section of the population and its nuances are to be fully appreciated by them". However, a teacher in this study successfully uses ICTs to expose learners to the language of learning and sparingly uses an indigenous language in his mediation between the language used by the technology and that of learners. It therefore all depends on what role the teacher wants the ICT to play in the teaching and learning process.

Du Plessis and Webb (2009) from the Faculty of Education at the University of Nelson Mandela Metropolitan carried out a study where they applied the learning as design framework to develop a Grade six class' critical outcomes. This framework had been used by Koehler and Mishra (2005) to prepare teachers for ICT pedagogical integration. In their study, Du Plessis and Webb, (2009) used the generative use of computers in a hypermedia project-based approach. The approach creates an environment where students "construct knowledge by designing and creating their own representations of knowledge through mindful and challenging learning" (Du Plessis and Webb, 2009:16). At this stage, learners would have acquired knowledge and skills they need to carry out the task. The learning experience is authentic, posing real-life problems that are ill-structured and demand deep thought and reflection. The findings showed that learners developed higher-order thinking characteristics like knowledge creation, became learner-centred, evaluators and analysers of knowledge through use of multimedia to design hypermedia artefacts (Du Plessis and Webb, 2009). In addition to acquiring technical skills, in this case ICTs were used by learners as a means to an end or to achieve the task goal which was successfully accomplished. Its success can be aligned to the approach used that compelled learners to identify and utilise ICT affordances that could help them best express their solutions to the posed real-life problems. Such usage of ICTs enhances learning through purposeful engagement of ICTs to make possible the development of learning.

Generally, these South African studies contribute to knowledge about factors affecting ICT integration. Conole (2004) has observed that although ICT research is increasing globally, it is focused on case studies and not on developing theories and approaches that underpin best practices. Although some of them attempt to indicate what is of value based on learner engagement with ICTs, none were identified that gave descriptions of what teachers do in their classrooms when they teach with these digital technologies. Wilson-Strydom and Thompson (2005) recommend, it is critical that research now goes into the classrooms, particularly of teachers who claim to be gaining pedagogical value in their use of ICTs in order to identify good practice especially in classrooms with limited resources which are the majority in the South African schooling system. The next section looks at how teachers are prepared for classroom ICT use in this country.

South African studies about preparing teachers for ICT integration

Minimum adoption of ICT integration is associated with lack of or inadequate teacher training on the use of ICTs for teaching (Blignaut et al, 2006; Mofokeng and Mji, 2010; Gudmundsdottir, 2010; Du Plessis and Webb, 2012). Although ICT teacher training programmes like Khanya Project, Gauteng on Line, SchoolNet South Africa and Intel® Teach to the Future have been launched in different provinces, findings from SITES indicated that ICT integration into subject teaching was still at entry stage (Blignaut and Howie, 2009).

It is possible that the less impact by the above initiatives was a result of inappropriate modes of training used. In their comparative study of the methods used to prepare teachers for ICT integration, Howie and Blignaut (2009) discovered that Thailand educators relied more on information they read from professional journals and yet South African teachers who used computers in their teaching preferred informal channels like colleagues and observations. This approach to learning is probably more ideal for South African teachers who are currently overwhelmed with teaching loads, overcrowded classrooms and administrative duties. Pischetola (2011) believes ICT should be integrated into people's local life and culture, and not be simply imposed.

Bialobrzeska and Cohen (2005) stress that, amongst a number of competencies the South African teacher needs, the importance of having basic skills, operating a computer, adapting available materials, evaluating software and websites and authoring a webpage cannot be ignored. While the ICT teacher trainings organised by the department of education seem to have focused on the first two competences, these authors believe the rest of the skills can be acquired informally or spontaneously. Based on the fact that teachers participating in this study have not had training on ICT use for their subject teaching, it is possible that once teachers have acquired basic skills they can develop abilities in integrating ICTs into their teaching, a notion Vandeyar (2015) argues is not a 'natural process'. However, it is in the interest of this study to know how these teachers go about integrating to a stage where they are able to use computers to the extent that they bring value to teaching and learning without training. The fact that, "In any school, how computers are used reflects a response to the circumstances (or needs) at the particular school at the time" (Bialobrzeska and Cohen: 2005) could be the motive and the reason behind their accomplishment.

Wilson-Strydom and Thomson (2005) investigated the level at which South African teachers are integrating ICTs. The research was specifically examining the teachers' uptake and application of

the Intel Innovation in Education Teach to the Future programme skills launched in 2000 in the USA. The programme's aim was to train teachers on how to integrate ICTs and on creating project-based learning experiences to enhance learning. Although 1078 teachers were trained in South Africa, only 231 teachers in this study responded to the questionnaires. The study revealed that 48.5 % used ICTs for teaching and learning more than once per month. 80.7% of those trained did not use them for teaching due to various reasons related to external challenges like access, time and technical support (Wilson-Strydom and Thomson (2005). In their concluding remarks, the researchers expressed concern that although most schools participating in this research were placed at the 'application' (second) stage of the UNESCO four level model for ICT integration, most teachers seemed to operate at lower levels (Emerging stage). For that reason they have called on future research to focus on pedagogical practices (which they did not capture in the survey), as they believe they are key to ICT integration.

A study by Mofokeng and Mji (2010) sought to explore teacher readiness to integrate ICTs into teaching mathematics and science of 58 Grade 7 to 12 teachers in the Gauteng Province and to detect what ICT training they would need to attend. Data revealed that 50 (86.2%) of the teachers did not use ICTs to teach mathematics and science. These findings discredits the efforts this province has made in the area of provisioning of ICTs through the Gauteng on Line (GoL) and teacher training through the department and other organisations like Microsoft, Intel and SchoolNet. Mofokeng and Mji (2010) conclude by pointing out that if ever computers are used in schools, they are utilised for low level utilization and they attribute that to lack of training and limited access to technology.

In their study, Du Plessis and Webb (2012) sought to understand perceptions of a sample of South African teachers to identify the requirements for a successful implementation of ICT Professional Teacher Development (PTD) in disadvantaged township schools. Their concern was that although the Guidelines for Teacher Training and Professional Development in ICT (DoE, 2007) stress the importance of a teacher training program that should help teachers acquire ICT knowledge, skills, attitudes and values, it does not make clear how the actual integration in the classroom should be carried out (du Plessis and Webb, 2012). The findings are based on teacher responses after a year-long ICT Professional Teacher Development. The results demonstrated that teachers were concerned about three main training features for an ideal workshop which are: facilitator competence and attitude or behaviour; school support and provisioning of continuous PTD; training contexts that are conducive to productive learning. du Plessis and Webb (2012) used the findings to develop an ICT teacher training framework that is made up of the following acronym:

C2RHOAR3FS2R2 referring to Care, Competence, Relate, Hands-on, Ongoing, Assessment, Reflection, Read, and Revise- replan, Feedback, Share, Support, Recognition and Resources. The Khanya project also identified facilitators as the weakest link as they failed to support teachers and provide them with adequate training (for their context), especially those in the disadvantaged schools. While the above frame provides the prospective trainer with helpful participant expectations, there is a need still for one that makes explicit what type of content and perhaps structure to incorporate to prepare teachers for effective enacted practice through engaging ICTs.

Studies in South Africa have looked at various aspects of ICT in education, particularly issues of ICT adoption, policy implementation and teacher training. What seems to be prevalent are case and a few comparative studies based on how specific schooling contexts relate or respond to the ICT in education policy or the impact of training and uptake of ICT use in South African classrooms. The findings, like many others carried out globally, do not provide explicit knowledge about how teachers integrate ICTs into their teaching but mainly make conclusions based on quantitative data. The information they provide, contributes little that can be used to develop a theory or framework that would assist teachers determine value in the ICT pedagogical integration process. Furthermore, as long as ICT teacher training programs are not grounded on demonstrating what works and does not work in the classroom, they are likely to continue missing the target. The target being that they prepare teachers to integrate ICTs into teaching by training them on the actual teaching with digital technology so that there is value in their usage of these technologies and consequently 'enhance learning'. In order to understand the South African context upon which this study is based on, the next section gives a description of the six South African schools that teachers participating in this multi-case study work from.

Context of this study



The aim of this study is to investigate how selected teachers maximise the use of the digital technologies they have access to in their classrooms to enhance teaching and learning. While the focus is on what is happening in their classrooms, the schools and the teachers are briefly described to give an impression of their working conditions.

All the six schools have computer laboratories with technical assistants who do not provide any technical support to the participating teachers during their teaching with ICTs as they seem to be more knowledgeable about the use of computers than the assistants. Both School B and C have an ibox with the same content from the machine sponsor and yet the level of the teachers' uses is different, as the presentation of data indicates in Chapter 5. Although the rest of the schools do not have an ibox, the equipment they use is more or less equivalent to the ibox as it is a combination of a computer and a projector.

School A

This secondary school is located in a Venda speaking community in one of the townships in Soweto. Although the school is not well resourced in terms of teaching equipment, it has a functioning library and a computer laboratory. There is a computer laboratory technician who teaches basic computer skills and monitors the use of the 25 Gauteng on Line computers by learners whenever they need to research on their class projects. Learners in this school do not pay schools fees and that could be contributing to the challenge the school has with maintenance of the classrooms which was evident in one of the classrooms that had patches of its ceiling missing. Use of ICTs by teachers for teaching in this school is optional. One of the two physical science laboratories is well equipped with teaching and learning resources. This laboratory even has a white board and yet the other one only has a green chalkboard. The teacher who participated in this study is not the HoD and his teaching venue is the less resourced science lab displayed below in Figure 1. The two participating teachers in this school teach Physical Science and English First Additional Language. Both teachers own the laptops and projectors they use in their classrooms. These teachers and the teacher from School B seem to be the only ones who are not using prepared digital content

from the department or the technology sponsor. The teachers prepare their own materials which are mainly in the form of text on slides or on MS Word.

The Physical Science teacher takes his learners to the computer laboratory for a lesson on drawing graphs; otherwise he uses his physical science laboratory to teach. The figure below is the physical science laboratory in which the participating teacher teaches.

Figure 1.1: School A - Physical Science laboratory



The physical science teacher's constraint in his integration of ICTs is the absence of blinds and a screen where he can project his subject content.

The second participant is the English First Additional Language teacher. The school time table demands that he moves from classroom to classroom to teach his subject and he carries his projector and laptop for use during the lessons.

Figure 1.2: School A - English First Additional Language classroom

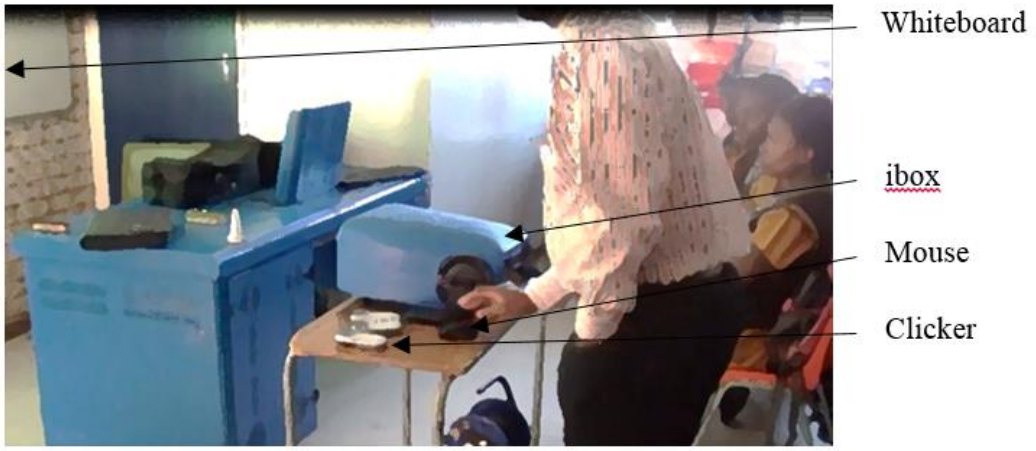


This teacher does not take his learners to the computer laboratory as he finds it impractical as learner numbers are double those of computers and they lack basic computer skills. The constraint that the English teacher indicates is that the projector is not installed and it takes teaching time to adjust it to the right position.

School B

This secondary school is also located in a Venda dominated community in Soweto which is about 6 km away from School A. Learners in this school also do not pay school fees. The school has a big computer laboratory (big enough to accommodate two classes of 40 learners) with 25 Gauteng on Line computers. The computers occupy a third of the room and are positioned at the back of the laboratory. On the other end of the lab, is the lesson presentation area. The figure below shows the set up for this area.

Figure 1.3: School B - Computer laboratory



The deputy principal teaches geography and is the ICT champion for this school and has the task of promoting the adoption of the machine for teaching. One of the teachers who was interviewed initially and later withdrew from the study as he felt he was not yet comfortable to be observed, pointed out that teachers in this school are 'forced' to use the ibox for teaching and he was one of those struggling to adapt to the use of the new technology. He found the use of the ibox a bit cumbersome considering that he needs to take time and prepare for the lesson whereas without it, he just carries his textbook and enters the classroom without any preparation. There is a schedule that has been prepared by the school where each teacher is allocated a day when he or she goes to the computer lab and present the lesson with the ibox. Learners have access to computers during these allocated times. Although the numbers of learners are big in this school, 2 to 3 of them work on a computer at a time in order to give all of them access during a lesson. Currently, the sponsor is in the process of designing and uploading content that is customized to the new curriculum, CAPS. Presently, there is Grade 10 to 12 content, in Physical Science, Life Sciences, Mathematics and Mathematics Literacy. The rest of the subjects and grades will be developed with time. The trainer from the sponsoring company visits the school regularly to train the teaching staff and to give them support with lesson preparation and presentation whenever they need assistance. He also follows up on teachers to check if they are keeping to their commitment of using the ibox once a week. When

data was collected, the deputy principal was the only teacher using clickers. Since there is no content for Geography, his subject, he creates his own slides with content and MCQ questions with the help of the technician from the company. He invites teachers in his school to come and observe as he presents so they can learn from him and perhaps arouse their interest as well.

School C

This school is located in a Zulu speaking community and it is a technical secondary school with one computer laboratory. There are 25 computers in this rather small room. Both teachers and learners have access to the computer lab during and after school hours. On the average, each class has 20 learners and as a result, learners do not share a computer like what happens in other schools in this study. During the first term of each year the participating mathematics teacher has a responsibility of training all learners in this school during afternoons in basic computer skills. He registers learners and gives them access to login as users. Thereafter, he leaves the rest to the subject teachers who are expected to take their learners to the computer laboratory where they can apply the acquired or learnt skills in their subject tasks whenever it is necessary. The teacher emphasized that since this is a technical school, it is important that learners have these skills as they need them for the technical subjects that constitute the core of the school curriculum.

Figure 1.4: School C - Mathematics classroom



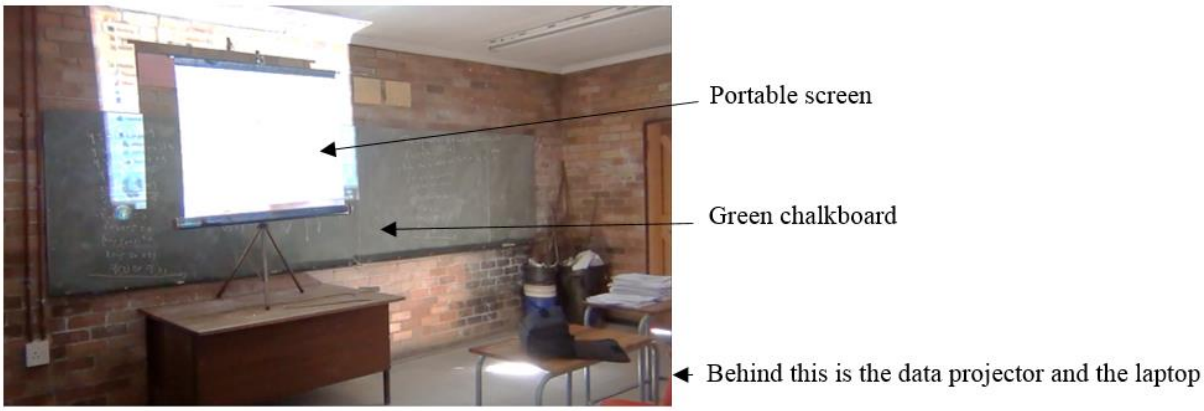
In addition to the computers in the lab this technical school has 6 laptops, 6 projectors and the ibox that are only available to teachers for subject teaching purposes. The ibox was introduced to the school in June last year (2013) and that is when he and other teachers started using it. He assists teachers whenever they need support with using the ICT to teach. He also invites them to come and observe his lessons whenever they are available. There is a technical assistant who is stationed in the computer lab to help other teachers and learners whenever they come to use the lab.

This Mathematics teacher believes that at present this school has no constraint where the use and availability of ICTs is concerned, making it distinct, considering its location and the socio-economic status that is the same as that of the other schools in this study. Previously, the school had two challenges. The first one was the problem of power cuts which was resolved early in the year (2014) by receiving unlimited supply of electricity. The second difficulty the school faced was limited internet connectivity and that was overcome when Wi-Fi was installed for school use in March 2014. Learners with cell phones, especially grade 12s are given access to the internet after school. However, learners are not allowed to use their cell phones during school hours. This teacher either uses the ibox (preferably) or the laptop and projector. Since he has programming skills, he gives his learners assignments or tasks that are time-controlled in the computer laboratory. He uses notepad and java to prepare tasks and homework for learners and uploads them online to extend their learning. Learners have access to these tasks in the computer lab or in their cell phones as long as they have access to the internet. This mathematics teacher also allows his learners to use the ibox when they present lessons to their peers during his lessons.

School D

This school is located in a community that predominantly speaks Zulu. It also has a Gauteng on Line computer lab that is currently not used for teaching and learning but learners use it for research purposes only. The electrical sockets in the participating teacher's classroom do not function and he therefore uses an extension code that goes through a window and connects to an administration office less than ten metres away. The classroom has a black chalkboard. He uses a mobile screen to project the video presentations. The teacher uses old newspapers to obstruct light from the windows.

Figure 1.5: School D - Mathematics classroom



The teacher is the Mathematics Head of Department and is the school ICT coordinator. At the moment, he is the only teacher using ICTs to teach in this school. For that reason, he does not have challenges with sharing the limited resources with other teachers in the school. The school has

recently received tablets from the Department of Basic Education which he says are meant to be used by grade 8 and 9 learners only. His grade twelve classes also use them for research purposes at times. The tablets came with Mathematics and English software.

School E

This is a comprehensive secondary school, with only grades 10 to 12. The school is located in a Zulu and Sotho speaking community and learners do not pay school fees. The participating teacher is the deputy principal and is the ICT coordinator for the school. The school has access to the internet, laptops, data projectors and tablets that the teacher says he must guard closely otherwise if any goes missing he is expected to replace it from his pocket. These gadgets are used for lesson presentation and research purposes. Teachers and learners in this school have access to computers in the library and the computer laboratory. The teacher involved in this study taught from the library that was set up as shown in Figure 6 below.

Figure 1.6: School E - library



He uses a laptop and a portable projector if ever he has to use digital technology in the classroom. The school's main challenge is theft and next is learner passivity when ICTs are used for teaching. Connectivity is unreliable as the school is networked with other schools and when they have electricity problems, they are affected. Since this is a non-paying school, the money the school receives from the government is not sufficient and as a result they rely on donations for additional digital resources and on the State Information Technology Agency (SITA) for technology maintenance which is not always readily available.

School F

This is a church school that benefits from the organization for physical resources and the department of education for curriculum interventions. For instance, teachers in this school belong and attend public schools' teacher cluster meetings and receive the same materials as the rest of them. The school is situated less than five meters from School D and for that reason they share the same community. The teacher is the only female in this study and she uses a school laptop and projector to teach all her lessons. Her classroom set up is as displayed below.

Figure 1.7: School F - Geography classroom



Although this school is located in the same township, it is a private (church) school. The challenge she pointed out is inconsistency in getting access to electricity, especially in winter, otherwise resources are not to be a problem. There is interactive whiteboard software that is currently used by her and the science teacher. She is the Head of Department (HoD) of Geography in the school, and is able to search and integrate her own material with that provided by the Department of Education. The school has a power failure challenge in winter and that impact negatively on the use of ICTs for teaching.

Conclusion

Although these schools are located in the same district, School C and F seem to enjoy more access in terms of infrastructure and resources than the other schools. It is possible that the fact that School C is a technical school the authorities have no choice as the subjects offered demand unlimited supply of electricity and internet connectivity for instance, while School F benefits from church funds. The teacher in School C is the only one who is a computer programmer by profession. The rest either are self-taught or they have been trained to use the ICT they teach with. What is interesting about School B is that the leadership is playing the key role in promoting the adoption of ICTs.

Research Assumptions

As has already been pointed out in the South African studies above, township schools generally have limited resources and they have inherited this economic status from the apartheid era that distributed its assets unequally. The ANC government has made great strides to redress issues of equity and yet its efforts seem to have a long way to go as the gap between its strayed educational institutions is too wide. Bloch (2009:10) argues that "enhancing resource inputs" has minimal effects on poorer schools, suggesting that redressing the issue of quality education in these schools is more complex than is usually implied. He calls for much more complex interventions geared at improving performance in these institutions. Based on the table below from the Results on the Annual National Assessment (ANA) for 2014, Grades 1 to 6 and 9 (DBE, 2014), this research assumes that teachers in township secondary schools (grouped in the lower quintile category) tend to underperform in international and local benchmarks (DoE, 2014; PIRLS, 2011; TIMSS, 2011) because they are not adequately prepared for the changes that are introduced into the system. Although the mediocre performance can be expected in the higher grades (Grade 10 to 12), teachers at this level engage various teaching strategies and technologies to remedy the situation. The table below presents ANA results by quintile for 2014. Quintile 1 is the poorest school.

Table 1.2: ANA average percentage marks for Mathematics and Languages by grade and poverty quintile (2014)

	Gr1	Gr2	Gr3	Gr4	Gr5	Gr6	Gr9
Quintile 1	65.1	59.2	52.5	32.8	32.1	38.1	10.1
Quintile 2	66.6	60.2	52.9	34.3	33.4	39.6	8.7
Quintile 3	67.4	60.4	53.9	35.6	34.5	40.4	8.2
Quintile 4	71.2	63.5	58.0	40.4	41.2	46.1	9.2
Quintile 5	78.4	71.4	68.9	52.9	55.0	60.3	21.6

Table 4.53: Average % mark in Home Language by grade and poverty quintile

	Gr1	Gr2	Gr3	Gr4	Gr5	Gr6	Gr9
Quintile 1	59.7	56.9	54.0	44.6	46.6	50.8	37.2
Quintile 2	60.8	58.2	54.3	45.5	48.2	52.8	39.6
Quintile 3	62.1	59.5	55.2	48.1	49.9	54.6	41.4
Quintile 4	66.0	64.3	56.8	54.1	53.9	60.3	43.8
Quintile 5	76.1	75.9	67.3	65.4	65.5	70.9	55.5

Table 4.54: Average % mark in FAL by grade and poverty quintile

	Gr4	Gr5	Gr6	Gr9
Quintile 1	38.7	44.0	43.0	32.4
Quintile 2	40.2	46.2	44.7	33.6
Quintile 3	42.7	48.0	46.6	34.7
Quintile 4	46.5	52.2	50.6	37.0
Quintile 5	49.8	56.9	60.0	42.9

Source: DoBE, (2014)

Although Bloch (2009) confirms that the conditions inherent in rural and township schools relate to their poor academic achievement, in the past few years some township schools have risen against odds and drastically improved their Matriculation results. This can be attributed to these schools increasing teaching and learning time. The use of ICTs has been one of the strategies that education authorities have advanced in order to enhanced teaching and learning in these schools. However, teachers still need to be prepared to effectively use available digital technologies in their classrooms if the quality of South African education is to be improved through these gadgets.

According to Laurillard (2002), it is teaching, the conversations that develop learning, and technologies enhance these experiences in the classrooms. It is therefore possible that the way teachers in these schools use ICTs could be linked to their knowledge, skills, philosophies or beliefs about teaching their respective subjects. If in their beliefs about learning a subject for instance they value the development of subject thinking skills, their use of ICTs for teaching would be reflected in their practice. Lastly, the ICT in Education policy's expectations appear not to relate to township schools as they have limited resources and low teacher ICT integration capabilities. This study assumes that participating teachers will not sufficiently meet the pedagogical value anticipated.

Purpose Statement

The aim of this study is to use both teacher espoused and enacted practices to understand the pedagogical integration of available digital technologies of seven selected township secondary school teachers that claim their use of ICTs has educational value. The findings will inform the development of a generic ICT teacher training framework for all South African teachers. Since the relevance of the framework to be developed is critical for this study, a document analysis of the South African national curriculum statement and three ICT in education policies serves the purpose of grounding the study to a particular context. It is hoped that the framework will later be used to bring about a paradigm shift in the South African teachers' understanding of ICT pedagogical integration through incorporation of technology in the designing and facilitation of learning experiences and environments that promote this country's educational goals. This study engages Laurillard's (2002) Conversational Framework to describe the teaching practices of the participants and the media forms and affordances (Conole and Dyke, 2004) to identify what is of pedagogical value in their teaching. The teacher in this discourse is the agent of a successful learning experience that he makes possible through classroom dialogue, an activity that Laurillard (2002) describes as teaching. This research, therefore seeks to understand how teachers go about engaging ICTs to enrich their teaching, the classroom dialogue. In other words; how are technologies used in a way that teaching methods and created learning environments promote construction of new

understandings to enrich learning? This is a multi-case study and each teacher is a case whose findings will hopefully present different forms of ICT pedagogical integration that can be used in the context of educational policies for the diverse classrooms found in this country.

Research questions

The study seeks to utilise a description of how teaching and learning can be enhanced by digital technology by exploring the relationship between teachers' espoused and enacted practices. This will be used to inform the development of a generic framework for preparing FET South African teachers for an effective and relevant ICT pedagogical integration. The main research question is therefore:

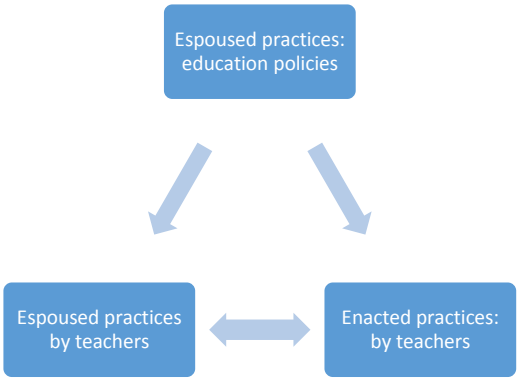
Question

What is of pedagogical value in the classroom practices of seven South African secondary school teachers with ICTs?

Sub-questions

The figure below illustrates the key sources of data that will be used in this study to respond to the main research question above.

Figure 1.8: The data set triad



1. What is deemed to be of pedagogical value in teachers' own espoused practices with ICTs?
2. What is implicitly assumed as of pedagogical value in the teachers' enacted practices?
3. To what extent are teachers' espoused practices reflected in their enacted practices?
4. What do the South African education policies consider to be of pedagogical value in the use of ICTs?
5. To what extent are teachers' practices consistent with the assumptions of policy?

Outline of Chapters

Chapter One: Introduction

This chapter describes the state of ICT in education in South Africa as portrayed by studies carried out in the past seventeen years to try and provide a background for this study to facilitate the rationale for this undertaking. The purpose statement and the research questions are also included.

Chapter Two: Literature Review and the Conceptual Framework

This chapter lays ground for the concepts used in this thesis to try and develop an argument that can help engage with data in the context of this study.

Chapter Three: Research Design and Methods

The research methods appropriate for the type of study that this investigation has undertaken are presented and justified in this chapter. The discussion centres on how the research approach adopted is apposite for a deep examination of how ICTs enhanced the selected teachers' classroom conversations.

Chapter Four: The Development of the Analytical Framework

The analytical framework is developed from Laurillard's (2002) media forms as well as ICT affordances by Conole and Dyke (2004). Thereafter the language used and how it will be used in the framework is explained.

Chapter Five: The Value of Teacher ICT Integration into Teaching

The data from the espoused and enacted practices of the seven teachers is presented and interpreted through this study's analytical framework. Later, the interpretations are used to make decisions on the consistency between the espoused and enacted practices.

Chapter Six: Pedagogical Value of ICTs Espoused by the South African Education Policies

This a document analysis of the national education policy (CAPS), the ICT in education policy (White Paper on e-Education), the Guidelines for Teacher Training and Professional Development in ICT and the Guidelines on the Management and usage of ICTs in Public Schools in Gauteng. The description of each document forms the policy framework that is further analysed through this study's analytical framework. Ultimately, the interpretations from the teachers' espoused and enacted practices are examined for alliance with the policy framework.

Chapter Seven: Discussion

Emerging themes and findings are discussed in this chapter.

Chapter Eight: Conclusion

Broader problematic theory and knowledge contribution, concerns and the contribution this study makes to the theory is presented in this chapter.

Chapter 2

Literature Review and Conceptual Framework

Research Question:

What is of ICT pedagogical value in the classroom practices of seven South African secondary school teachers?

Sub-questions

1. What is deemed to be of pedagogical value by teachers in their own espoused practices with ICTs?
2. What is implicitly assumed as of pedagogical value in the teachers' enacted practices?
3. To what extent are teachers' espoused practices reflected in their enacted practices?
4. What role do the South African education policies play in the pedagogical use of ICTs by the teachers?
5. To what extent are teachers' practices consistent with the assumptions of policy?

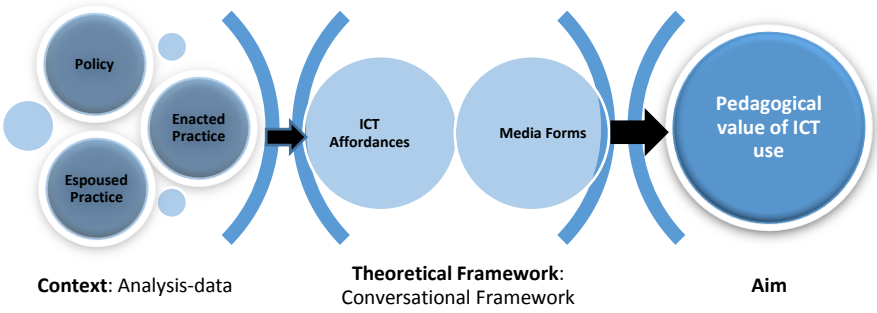
This study has adopted Laurillard (2002), as its main contributor for her emphasis on the role of the teacher as the change agent in the adoption of ICTs into the classroom. This literature review therefore engages her ideas to try and make visible what is of pedagogical value in the integration of ICTs into subject teaching. A discussion of what and how ICT affordances can contribute to the use of digital technology in the context of teaching and learning is also engaged. Thereafter factors that influence successful ICT integration are discussed by examining the relationship between teachers' espoused and enacted practices. Lastly, in trying to contextualise this study, a review of what the two main South African education policies engaged in this study is employed in order to find out what they consider to be of pedagogical value.

The following conceptual framework provides a structure that is employed in this study to help respond to the research questions.

Conceptual framework

This study aims at identifying what is of pedagogical value in the use of ICTs by seven teachers in six South African township secondary schools. The ultimate goal is to use the findings to inform an ICT teacher training framework that can help prepare teachers in schools with limited resources to effectively integrate ICTs into their teaching. This conceptual framework demonstrates the sequence of the course this study will take as it seeks to accomplish this objective.

Figure 2.1: The Conceptual Framework



Language of Description

Laurillard's (2002) Conversational Framework has been identified as a model that can help explain and make visible the pedagogical impact of digital technologies in teaching and learning with and through ICTs. That has been necessitated by the need to provide an informed justification for what is deemed to be of pedagogical value in the policy goals, the espoused and enacted practices. This review also engages Hudgins (1977), Conole and Dyke (2004) and Ertmer (2005) in addition to Laurillard (2002) as key contributors to pertinent aspects of this study:

1. **Laurillard**: Conversational framework
   Construction of knowledge happens through explicit teacher-learner interaction. ICTs enhance this interaction and the media forms help to categorise their role in the conversation.
2. **Hudgins**: Learning conditions
   Conditions that promote learning and creation of conducive learning environments.

3. **Conole and Dyke**: Affordances
   Utilisation of ICT affordances by teachers to achieve educational goals.
4. **Ertmer**: Espoused and Enacted Practices
   Teacher beliefs and how they influence their actual teaching with ICTs.

The media forms (Laurillard, 2002) developed from the Conversational Framework together with Conole and Dyke's (2004) ICT affordances form this study's analytical framework and are discussed and integrated into the literature review. What influences or informs the pedagogical integration of ICTs in teachers' classrooms is discussed in order to understand the relationship between espoused and enacted teacher practices. Laurillard's (2002) framework as the theory for this study will now be discussed to establish the context from which components of the conceptual framework are developed.

The Conversational Framework

In the development of her framework, Laurillard (2002) clearly establishes what she believes teaching is. She supports Ramsden's view that it is not about imparting knowledge, but about making "student learning possible" (Laurillard, 2002:11). It is important therefore for teachers to be aware that the inaccessibility of academic knowledge, demands that it be mediated to make learning possible. This gives a lot of responsibility to teachers as they do not only need to know the content, but the knowledge about learning and what their role should be in facilitating its 'birth' (coming into being) as well.

In her argument for the significance of the role of the teacher, Laurillard (2002) says,

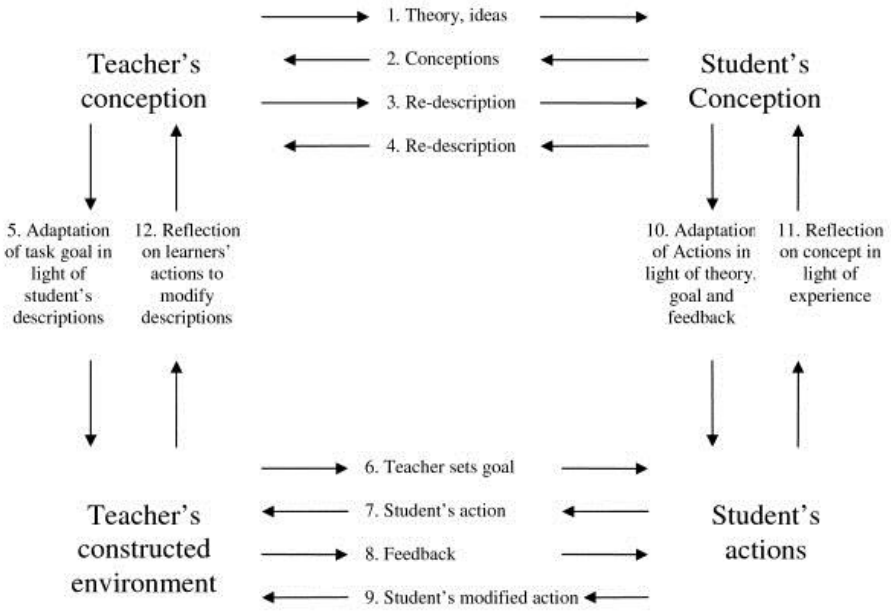
> Teaching as mediating learning involves constructing the environments which afford not only learning of the world, but also learning of descriptions of the world. The means of access to the two types of knowledge is different, the one is direct, the other is mediated. Because academic knowledge has this second-order character, it relies heavily on symbolic representation as the medium through which it is known.

There is a need in the mediation process for learners to be oriented into these descriptions. The use of symbols in the descriptions is another challenge that teachers have to deal with. Learners rely on them (teachers) to make sense of and be able to use them as tools they can engage to solve authentic problems related to their discipline. What makes teaching more problematic is that these symbols are not accessible to learners' daily lives and that makes it difficult to acquire them. In addition to that, learners come into the classroom with preconceived ideas that might be difficult to penetrate.

This may result in misinterpretations of the teacher's descriptions and as a consequence, produce unfavourable performance. How then can the teacher avoid this inevitable outcome?

Laurillard's, (2002) Conversational Framework demonstrates how misunderstandings are exposed and instantly dealt with in the learning activity through teacher-learner interaction in the learning process. The Conversational Framework below shows how the learner is able to expose his or her interpretations of given descriptions and eventually adapt to the learning goal through the teacher's guidance during the learning process.

Figure 2.2: The Conversational Framework identifying the activities necessary to complete the learning process



Source: http://www.biomedcentral.com/1472-6920/10/12/figure/F2 -a representation of Laurillard (2002:87)

It is also through this interaction that learning develops to a stage where the learner is able to demonstrate his or her ability to successfully apply or transfer the knowledge acquired in different situations.

In this interaction, the teacher uses learner feedback to adapt classroom conversation while guiding the learner to desired understandings of the concept. On the other hand, the learner receives feedback from the teacher and uses it to adapt his or her present understandings. As the process carries on, the learner eventually demonstrates the same or similar 'descriptions of the world' as that of the teacher or the subject matter in his or her reflections and performance in the tasks assigned by

the teacher. Laurillard (2002) summarises these learning activities as 1) Discursive 2) Adaptive 3) Interactive and 4) Reflective. The extract below gives an overview of what each learning activity entails:

Extract 1: Description of the learning activities

- The discursive process is represented as a series of activities by teacher and student at the level of descriptions of the topic goal: describing and redescribing each participant's conception of it (activities 1-4).
- The adaptive process is represented as activities (5 and 10) internal to both teacher and student, each of whom adapts their actions at the task level in the light of the discursive process at the description level.
- The interactive process is represented as a series of activities (6 to 9) by teacher and student at the level of the task environment, setting and aiming to achieve the task goal, giving and acting on feedback in the light of the task goal.
- The reflective process is represented as activities (11 and 12), internal to both teacher and student, each of whom reflects on the interaction at the task level in order to redescribe their conceptions at the level of descriptions of the topic goal.

Source: Laurillard (2002:86)

An effective, productive and valuable use of ICTs would therefore entail using them to create learning environments where both the teacher and learner utilise these interchanges to develop learning or concept understanding. It is in the interest of this study to make explicit the contribution made by ICTs as the participating teachers integrate them into their subject teaching. There is therefore a need to detect where and how in each of these activities the use of digital technology is bringing value. Laurillard (2002) produced a typology of media types developed from her considerations of the learning activities. This study uses it to evaluate the use of digital technology in the teachers' practices. Laurillard (2002) uses the term, 'media' to refer to both digital and non-digital resources. In the description of the integration process, it is important to differentiate between the two. This thesis will therefore make the distinction to avoid creating confusion in the descriptions.

Media forms

Romiszowski (1988:8) describes media as "carriers of messages, from some transmitting source (which can be human or an object) to the receiver of the message". This transmission occurs in different forms and ways. The effects of multimodal texts for instance contribute to the effectiveness of the process. Information and Communication Technologies are able to provide these characteristics through hardware and software.

Laurillard's (2002) media forms' grouping is based on making clear what role media plays at the moment they are integrated into any learning phase in the activity. In other words, what type of benefit do they bring to the specific teaching and learning experience? While the role a medium plays can relate to its affordances, it is the teacher that determines its choice and how it is utilised to achieve a particular benefit to the mediation process.

The media categories suggested by Laurillard (2002) are as follows: Narrative, Interactive, Communicative, Adaptive and Productive. In a way, they are linked with the learning activities in the sense that they cover the whole learning cycle, from the introduction of the concept to a stage where the learner is able to articulate his or her own conception of the concept through a medium.

The above description of media by Romiszowski in Laurillard (2002:82) refers to them as carriers of messages that end with the receiver who in the case of this study is the learner. Laurillard's (2002) consideration of both digital and non-digital resources as media in most of her examples promotes applicability of her ideas in a wide range of contexts. However some of the examples of software and hardware she gives are out of reach for participating teachers. An adapted language of description is used, not in the learning activities but in how the affordances of an ICT are utilised and integrated into teaching in a way that brings value to the teaching and learning process in this study's context. That is done in chapter 4 where the analytical tool is developed. However, in this literature review, Laurillard's descriptions of media forms are maintained in order to establish sound understanding of their value to teaching and learning before adapting them to the context of this study.

Narrative media

The narrative media forms are non-interactive and are usually used to present subject content structure. Laurillard (2002) adds that,

> The Conversational Framework suggest that if the narrative presentational media are to move beyond the limits of the solemnly silent, uninterrogatable text to meet the

> demands of the learning process, then they have to structure the narrative to engage the learner in reflecting and articulating at the discursive level, and in playing some vicarious part in adapting and acting at the experiential level.

In a way, Laurillard (2002) is advocating for an approach that is not linear, otherwise learner participation is either insignificant or non-existent and that does not align with the discursive phase she presents in her framework. This can be achieved as teaching methods and various technologies are integrated as the teacher's rhetoric is in progress. Media such as lecture, print, audio vision, television, video and the DVD are suggested as examples that can be engaged in this narrative phase.

Interactive media

In order to formalise the importance of learner participation in the progression of the activity, Laurillard (2002) includes the interactive media form in her categories. Although this media form is linear, the ability of the user to "navigate and select content at will" makes it interactive (Laurillard, 2002:107). In the case of a student using it, the challenge in its use in the Conversational Framework's learning activities is that although there is learner control, it cannot give feedback to him or her. This technology affordance can waste learning time if learners for instance are using web resources without direction on which sites they should visit for the activity they are working on. That can lead to learners going "through the resources without either reflection or adaptation. Interactive hypermedia do not necessarily offer a productive learning environment" (Laurillard, 2002:110). However, with adequate knowledge and skills, understandings can be broadened and deepened through this 'trans disciplinary' resource. It would be interesting to know, in the case of the teacher being the only user, if learners can experience the same benefit from the usage.

Communicative media

The communicative media can support discursive media in the sense that participants can have space to discuss or debate an aspect of a concept. At this stage interaction is "at the level of descriptions, and reflection, feedback and goals" (Laurillard, 2002:146). All is experienced at the same time in this learning environment, if carried out synchronously or delayed in the case of asynchronous discussions. The benefits of this media form to learning, relies on the quality of the interaction as constructed and guided by the teacher or the mediator. The examples of this type of media form are audio conferencing, video-conferencing and student collaboration (Laurillard, 2002).

Adaptive media

The adaptive media is different from the interactive media in the sense that the user can change "their state in response to the user's actions" by using "the modelling capability of computer programs to accept input from the user, transform the state of the model, and display the resulting output" (Laurillard: 2002:126). That way, the user is able to receive intrinsic feedback that he or she can use to modify learning. The feedback must be meaningful to learners and they should find it "easy to interpret in relation to the goal they are trying to achieve" (Laurillard, 2002:127). It therefore plays a role in the adaptation of new knowledge during the adaptive learning phase in the Conversational Framework (CF). The examples provided for this media form are simulations, virtual environments, tutorial programs, tutorial simulations and educational games (Laurillard, 2002).

Productive media

The productive media are technologies that can be used by learners to articulate their conceptions. At this stage learners are independent and are able to use acquired knowledge and skills to express their own understandings of new concepts or apply them as they construct solutions to authentic problems. The type of production depends on the subject and different forms of media that can be used as construction or presentation tools. Examples of media that can be used to achieve this role are micro worlds, power point and modelling (Laurillard, 2002). Because of inadequate digital resources, teachers are not always able to give learners an opportunity to engage with this type of media, but can have them work from paper or any other non-digital media to apply the same principles. This kind of usage by students does not illuminate the role of ICTs. The teacher could present a model of the product desired digitally, and let learners have a similar version using different resources. This would call for creativity and an ability to adapt ideas in a different context?

Although benefits from these media forms are not conclusive, they suggest how and where they can support each learning activity. Laurillard's (2002) intention seems not to directly link learning activities in the CF with media forms, as she suggests that the utilisation would depend on the topic, learning or task goal. The discussion below attempts to raise issues in the relationship between media forms and the CF that this study works from in its development of the analytical framework in Chapter 4.

While this study finds the media forms useful in grouping media, it struggles to locate both the narrative and the adaptive media form in the discursive, considering that one of the learning

activities in the CF is the adaptive phase and has descriptions similar to those of the media form. Secondly, whereas the interactive media's description seems to meet the discursive, where the teacher-learner interaction provides feedback from the learner that the teacher uses to guide or shape the initial descriptions, the interactive process in the CF appears to be at the level similar to that of the adaptive and communicative media. This is because learners at this phase adapt to teacher descriptions as they carry out given tasks.

However, the reflective process in the CF tends to relate well to the productive media as at this stage the learner is equipped to articulate him/ herself. This study finds the account of the CF and the media forms significant in enhancing the understanding of the value ICTs bring to the teaching and learning experience.

In order to make visible the contribution of digital technology, the next section discusses ICT (in particular) qualities or affordances that can be employed in the classroom as the media form is engaged.

ICT Affordances

In addition to the affordances that Laurillard (2002) highlights in her media forms, this study has identified Conole and Dyke's (2004) taxonomy of ICT affordances as they expound on her input. They have proposed the following taxonomy: Accessibility, Speed of change, Diversity, Communication and Collaboration, Reflection, Multimodal and non-linear, Risk, fragility and uncertainty, Immediacy, Monopolisation and Surveillance. Their effort is aimed at contributing to "a more systematic application of the use of ICT for learning and teaching", (2004:114). Out of the ten features in their taxonomy, the following five were selected for their close relevance to the selected media forms. These are: multimodality, immediacy, diversity, collaboration and reflection. 'Reflection' could not be included in the framework as this aspect can be applied anywhere and anytime in the learning activity. Instead, 'articulation' from Laurillard's (2002) description of the productive media form was adopted. This research uses these affordances to elaborate on the media forms. As the affordances are discussed in the following section, what is observable will inevitably be mentioned to give a clearer outlook to how they are used and the value they bring to the teaching and learning experience.

Multimodality

Multimodality entails integrating different modes of communication which can be in the form of text or media. Texts can broadly refer to written texts (names), images (shows), colour (highlights frames) or graphics (illustrates), (Kress, 2010 and Clark and Mayer, 2008).

Multimodality is linked to the narrative media form and is thus used to deliver content. The availability of multimodal texts in the web promotes non-linearity as learners are able to move from one type of text to the other and by so doing, enable them to move "beyond linear pathways of learning" (Conole and Dyke, 2004:119). Laurillard (2012:119) adds that digital media is not better than conventional media in the sense that "simply relying on the wonderful ease of access to multiple narratives provided by the internet" can result in poor conception of the content structure. She therefore proposes that the teacher takes the responsibility of structuring it intelligibly and interpreting the 'symbols' used so they make sense to learners as already mentioned. In the narrative media, Laurillard (2002:91) gives conventional examples such as "lectures, books, films, and television programmes" and later adds digital media like "web documents, animations, podcasts, and videos", Laurillard (2012:119).

Immediacy

ICTs have increased the speed of receiving responses to the extent that people can communicate in real time. Conole and Dyke (2004) consider ICTs as an avenue that can be used to solicit quick response and is applicable to online learning environments. In a learning situation that gives both teacher and learner an opportunity to get feedback instantly, that can be used in the development of the learning process as demonstrated in the CF. Laurillard (2002) associates this affordance with the ability by the user to navigate with ease and being in control of what and when to view content. It is evident therefore that this affordance can be manipulated as perceived for different purposes (Hammond, 2009).

Collaborative

Conole and Dyke (2004) applaud this affordance for making it easy to communicate and share information over distances. They align these behaviours to Wenger's notion of Communities of Practice and Social Constructivism by Vygotsky and how they can promote learning. They are also concerned about the quality of these dialogues and other social issues that may impact on feasibility issues and their value to learning. Nevertheless, Laurillard (2012) emphasises the importance of participation by the members of the group as they all negotiate the outcome of their task. In her attempt to demonstrate that collaboration has pedagogical value, Laurillard (2012:189) states,

> The group is valuable to each of its members because it makes demands on them to produce a contribution to the group goal. In the process of doing so the learner has to construct an idea, explanation, or description. This idea is then available to others to challenge or modify, and for the originator to defend or redevelop. Each member of the group reciprocates the demands and contributions of others.

In such a case learners learn to defend their conceptions and where there are errors, other learners are able to work together with them through interaction until they all share the same understandings. In addition to gaining desirable understandings, learners' higher order thinking skills are developed as they justify and negotiate meanings. Crook (1994:150) accentuates the value of collaboration by adding that the experience can result in a learner cognitive restructuring that comes as a result of "pressure simply to articulate the logic of one's position stimulates greater reflective self-awareness".

Diversity

This affordance is valued by Conole and Dyke (2004) for its ability to present learners with other people's experiences thereby giving them an opportunity to extend their learning experience beyond theirs. Evidence of this affordance is "overseas web sites, access to subject experts, or simulations to replicate complex behaviour" Conole and Dyke (2004:117). These authors express reservations on the validity of simulations due to the possibility that the real occurrence might be misrepresented. Tait in Laurillard (2002) also expresses uneasiness in considering simulations as significant in the learning experience in the exclusion of the teacher to offer explanations to support them. The implication in this case is that simulations are sufficient in making learning take place. However, Webb (2005:728) presents the following advantages of simulations as affordances:

- New affordances for learning especially when they are based on a "phenomenon that cannot easily be observed and explored in the real world".
- If based on lab experiments they can be provided with similar affordances but be more usable to facilitate interaction and thinking about the phenomena.
- They can bring about conceptual change and enable students to work at higher cognitive levels.

It seems the development and establishment of conceptual understanding should be the goal for engaging this affordance if it will be of benefit to learners.

Articulation

This affordance enables learners to express their views of the knowledge and skills they have acquired during the learning process. This can be achieved from digital and non-digital media forms. Learners are able to create their own models of the descriptions of the world (Laurillard, 2002).

Factors that influence engagement of affordances

A clear understanding of what ICTs can do to effectively enrich a teaching and learning experience is critical (Conole and Dyke, 2004), particularly in cases like South Africa where teachers are slow to adopt these technologies (Britain and Liber, 1999). The framework to be developed from this study is an attempt to intervene in this regard. In fact Conole and Dyke (2004: 113) call for studies that investigate how properties of technologies can be "exploited in particular learning and teaching contexts".

Affordances are a concept that was introduced by Gibson (1986:143), and defines them as "properties taken with reference to the observer". He believes that these properties as perceived by the actor afford opportunities for action. Once the actor becomes aware of them, action is taken and the technology becomes effective. Allen, Otto and Hoffman (2003:227) take this a step further by adding that, "A curious phenomenon emerges in humans when effectivities engage with affordances. The affordances often seem to disappear from awareness". This aligns with John and Sutherland (2005:408) who cite Wenger's assertion that states, "for technology to be used effectively in any learning process it must be highly visible as a learning tool but at the same time highly invisible as a mediating technology". They continue, "a computer user is no more aware of a mouse than she or he is aware of his or her fingers" (2005:228).

To Gibson (1986), perceptions play a big role in what the technology is used for. What teachers use the technology for is not only restricted to the real affordances it has as per manufacturer's instruction, but it goes beyond that. It is therefore possible that a teacher can be found using an ICT hardware or software in a different way from that which it was originally designed for.

The technology users' past knowledge and experience also have an influence on how technology is perceived, (Norman, 1988). Different teachers can for instance use the same ICT differently because they perceive its affordances differently. Furthermore, Norman (1993) distinguishes between real (related to the manufacturer's design) and perceived (as perceived by the user) affordances. The 'real' affordance does not change as the need of the user changes, as he or she might not "perceive

or attend to the affordance, according to his needs, but the affordance, being invariant, is always there to be perceived" (Gibson 1986:139). The perception one has of an affordance therefore "depends on the information available as well as the person's disposition" Webb (2005:707). In a case where there is limited knowledge or experience about the technology, the use of real affordances might not be maximised as the user would only focus on how he perceives it in the context of his or her needs. Although the use of an affordance seems to depend on the following two factors: the degree of perceptual information and the degree of affordance (McGrenere and Ho, 2000), the urgency to satisfy a pedagogical need is likely to be the driving factor. In the case of teachers in this study for instance, it is mainly the teacher and learner needs that seem to determine the type of use, regardless what the teachers' experiences with ICTs are.

The quality of ICT use in the classroom is critical if its usage will not be a disruption or compromise the value of teaching and learning. Armstrong et al. in John and Sutherland (2010) argue that teachers should first be equipped with 'theoretical tools' if they will develop teaching approaches that will take full advantage of ICTs for learning. It is these theoretical tools that should empower teachers to go beyond 'real' affordances to help them operate or see beyond what the ICT appears to afford as they seek to advance educational goals.

ICT affordances do not only augment learning but can change "the habitat in which we live. The new habitat affords a new way of living", (Boyle and Cook, 2004:296). This notion could imply that the presence of ICTs can disrupt the culture or classroom norms either for better or worse. A worse scenario could be a case where technology restrains the teacher from attending to learner needs by focusing on its affordance at the expense of teaching effectiveness. In such a case, the presence of technology dominates and that could lead to the teacher being inflexible and confining classroom conversation to the content on the technology. By so doing the teacher may disregard other teaching strategies, for instance examples outside the classroom that learners are familiar with to enhance learner understanding.

Sutherland et al. (2004) propose that both digital and non-digital technologies be used for learning at the same time to enrich teaching and learning experiences. A positive influence could be observed in a teacher whose use of ICTs alleviates his rhetoric by engaging out of reach occurrences to concretise abstract concepts to help learners adapt to new understandings. However both aspects (negative and positive) can be experienced. For instance, while saving presentations might be an

advantage in preserving teaching and learning time, Hammond (2009) warns that this might restrain teachers from being more spontaneous in their classroom conversations.

In the case of teachers who do not experience positive results in learner or teaching performance, in their response to a paper by Boyle and Cook (2004) challenging their earlier work on ICT affordances, Conole and Dyke (2004:302) argue that once unintended consequences are produced, there should be "creative and adaptive interaction with the environment and not any compliant response to any designed features of that environment". This ability incorporates both 'theoretical' as presented in Shulman's (1986) pedagogical content knowledge (PCK), technological knowledge and skills to allow for that resourcefulness (John and Sutherland, 2005). Teachers who lack either may struggle to manipulate the learning environment at any level to rescue the situation.

Tools do not only influence the environment, but practice as well (Hammond, 2009). For example, in the use of the Interactive Whiteboard learners are not restricted to their chairs but are invited to participate in the space that the teacher previously occupied (Hammond, 2009). The teacher has to adapt his behaviour to accommodate this new way of interacting with learners. A teacher who now uses a remote control device or Mobi View and a laser no longer has to move to the front of the class to write or point at the board at close proximity, but is able to stay close to learners and monitor their feedback (both in verbal and body language) he gets from them. He or she can also make sure they are busy working and educationally occupied at all times. Furthermore, if the affordance has a model of desired standards in content delivery, the influence could result in the advancement of the teacher's practice and as a consequence improve learner performance.

The literature identified about ICT affordances in this study tends to link the effects of engagement to learner direct contact with technology whereas this study is positioned in a context where learners benefit from the teachers' use during the teaching process. Nevertheless, as already been mentioned, affordances can be manipulated to suit user needs. For instance, learners in classrooms with limited resources can benefit by being given visual global access to experiences that are not readily available.

Based on the discussions above, a wide spectrum of ICT affordance types can therefore be found in classrooms where they are used, more so that each will be informed by the individual teacher's perception and other factors. However, in this case, it is the patterns of teachers' digital media integration in the learning activities that should ultimately inform the development of the ICT teacher training framework.

This section concludes the theoretical component that is supposed to inform this study on how to detect pedagogical value in the use of ICTs by teachers. The next section attempts to use the concepts to further examine what is of pedagogical value in areas that make up pedagogy. These are generally learning, teaching and the learning environment.

ICT Pedagogical integration

Teachers need to have a clear meaning of what constitutes the concept (ICT pedagogical integration) and how to go about implementing it effectively in their classrooms. In the context of a classroom, Information and Communication Technologies (ICTs) are various digital resources used for teaching and learning. These technologies have diverse affordances that facilitate different ways of sourcing, storing and manipulating content in different forms of representations amongst other capabilities in order to accomplish specific educational goals. A clear articulation of these affordances is needed to understand how ICTs "can be most effectively used to support learning and teaching" (Conole and Dyke, 2004:113). It is not only the clarity that is of concern, but mainly how they are engaged so they can bring value to learning, considering that the constraints and opportunities they provide are relative to teaching and learning goals and or strategies (Hammond, 2009).

Pedagogy refers to "guidance-to-learn: learning in the context of teaching, and teaching that has learning as its goal" (Beetham and Sharpe, 2013:2). Teaching is therefore that which makes learning happen and Laurillard (2002) describes that as mediating learning. It is important for this study to expose this mediation process in order to identify the value ICTs bring to the practice. Pedagogy is not a momentary event although it appears so in the act, but involves teaching philosophies and other knowledge domains (Shulman, 1986) that influence what eventually happens in the classroom as learners are guided to learn. Beetham and Sharpe, (2013:2) extend the meaning of pedagogy to "how we understand practice, and how we apply that theoretical understanding in practice once again". In its attempt to achieve its goal, this study adopts these descriptions as they help in the interpretation of the two main data sets (teacher interviews and lesson observations).

Dron (2012:24) believes that pedagogy encompasses what the teacher does in order to "accomplish the process of instruction". In the case of this study, pedagogy involves what the teacher engages and how he goes about achieving the learning goal. Laurillard (2002) summarises this teacher's role by saying that it is that which makes learning possible. The objective of this study is to depict the value ICTs bring as they are integrated pedagogically.

While Dron (2012) argues that pedagogy should not be studied in isolation of what it is part of, for the sake of discovering benefit from using ICTs through examining its impact on teaching and learning, the urge to separate or pull apart the value of this element (technology) that is part of an already functioning mechanism becomes inevitable if it (impact) will be made visible. In order to expose the pedagogical value ICTs have in the teachers' teaching, this study deals with both, at the same time, but deliberately isolates the two by referring to the conventional teaching methods as pedagogy and ICT as the technology. That way the study is not focusing on one but both as their relationship is pertinent to the findings.

ICT pedagogical integration is defined by Williams in Wang and Woo (2007:149) as "a process of using any ICT (including information resources on the web, multimedia programs in CD-ROMS, learning objects, or other tools) to enhance student learning". The idea that it is a process associated and contributing to the learning experience suggests it is not stagnant neither does it occur on its own but within that which makes learning possible. It is therefore important that ICTs in this context are considered as part of teaching and not as add-ons. The next challenge is to demonstrate how this 'ideal' integration process can be implemented in order to prepare teachers for an effective integration process.

Laurillard has made the task of describing the value of ICT pedagogical integration feasible by making the distinction between the two (media and a model of what it takes for learners to learn in the CF) evident. Her distinction though does not separate the two as such but is aimed at suggesting how the two can work together. For instance, how media forms and their affordances can support learning activities at specific stages. Some of the advantages ICTs are claimed to have in an educational context are their ability "to decontextualize learning, to make explicit that which is implicit, and to accentuate that which is often unnoticed", (Hennessy et al., 2005:157) to help improve learners' grasp and application of new concepts. By so doing, they enhance learners' learning and as a consequence, improve their performance. Thierry et al. (2009:1) defines ICT pedagogical integration as,

> the appropriate, consistent and sufficiently regular use of ICT that produces beneficial changes in educational practices and improves students' learning. This type of integration unavoidably implies the routine use in the teaching and learning process".

This definition suggests some element of criterion that should determine what ICT pedagogical integration entails. However, the ultimate goal would be to improve learning. This is the outcome that this study would associate with ICT usage that is of value whenever ICTs are used. It is for that

reason that observation of one lesson for each teacher is considered adequate in identifying the value of the teachers' use of ICTs at the moment of usage. Based on the discussions engaged so far, pedagogical integration of ICTs refers to the use of ICTs to augment teaching and learning. As is apparent, care has been taken in this definition to exclude any indicator that may disqualify any other form of integration based on any given standards, as teacher perceptions of ICT affordances vary depending on reasons already given in the affordance section. However, this study does not seek to compromise quality usage of ICTs, but intends to discover the types of integration from teacher practices, determine their value and use them to develop an ICT teacher framework that would provide different levels of proficiency.

Having established the theory and what this study considers as ICT pedagogical integration, the next section aims at understanding elements of pedagogy that can help determine what is of value in the learning activities of the teachers' practices.

The Pedagogical value of ICTs

This study basically considers what is of pedagogical value as that which makes 'learning possible' Laurillard (2002). The goal now is to try and make explicit what it is in the teacher's attempt to make learning possible that needs to be enhanced. According to Laurillard's logic, an understanding of how learners learn becomes a priority. Considering that the theoretical framework adopted in this study is developed from constructivism as a learning theory, this section will begin with engaging it to try and understand how learners learn in this context.

Constructivism

Although some scholars believe that constructivism is a vague concept, it has been debated broadly and a number of theories have emerged from this model, making it one of the most influential philosophies to learning and teaching approaches in this era.

There are the 2 major types of constructivism: the Cognitive, developed by Piaget and Social Constructivism, by Vygotsky (Powell and Kalina, (2009). Cognitive constructivists believe knowledge is constructed individually and social constructivists consider learning to be constructed through interaction with the mediator (teacher, learner or expert) through the use of mediation tools (language and cultural artefacts) and later internalised. What is common about the two is that "ideas are constructed from experience to have a personal meaning for the student" (Powell and Kalina,

2009:241). Based on this premise, this study will begin with social constructivism to see where and how learning presumably begins.

Social Constructivism

While Lev Vygotsky values Piaget's insights about individual learning, he believes social interaction is an essential part of learning. His study focuses on social constructivism and language development, particularly in the area of "cognitive dialogue, the zone of proximal development, social interaction, culture and inner speech" (Vygotsky cited in Powell and Kalina, 2009:243). In her Conversational Framework, Laurillard (2002) attempts to make this process visible by demonstrating how through teacher-learner interaction, the teacher is able to develop learner understanding of new concepts. Vygotsky believes this internalisation is more effective "when there is social interaction" (Powell and Kalina 2009:244). With the guidance of the mediator or the teacher in this case, ICTs can support or provide platforms for this interaction that has potential to develop learning. This study seeks to understand how teachers tape into affordances of the limited digital technology in order to enhance their classroom dialogue that is made up of these interactions.

The zone of proximal development (ZPD) is described by Vygotsky as a "zone where learning occurs when a child is helped in learning a concept in the classroom" (Powell and Kalina, 2009:243). Vygotsky believes children find it easy to learn within this zone when others are involved and as they interact. When the learner has achieved the intended learning outcome, the actual level of development is established. It is therefore critical that this phase be attained to pave way for further acquisition or development in understandings. This notion suggests a progressively organised knowledge in complexity which constructivists refer to as scaffolding. The teacher and 'others' play an important role here as they act as 'mediators' between new knowledge and the learner, by giving support and engaging strategies that help the learner connect what they know with what is new and eventually accommodate new knowledge and ultimately internalise it. The teacher's engagement of the multimodality affordance and adaptive media can help learners make these connections through language.

Vygotsky's social constructivist theory highlights the role of mediation in the learner's development from what he or she can do independently (actual development level) to what can be done by the 'novice' with the assistance of the 'knowing other', (the zone of proximal development level -ZPD) (Moll, 2001). At the actual development level, the learner's understanding of a concept is established to the extent that he or she can operate within the limits of the knowledge acquired with little or no effort. In conjunction with Piaget, Vygotsky's theory advocates that knowledge is not

transmitted but constructed during the interaction of the learner and the mediator who can be the other learners (peers) or the teacher as they use different mediation tools. This forms the basis for Laurillard's (2002) argument that she uses to develop her framework that shows how a learner visibly participates in this construction of knowledge. The advantage of this participation in this study is that it helps determine learner understanding as teachers engage ICT affordances in the mediation process.

According to Vygotsky (1987:282), "Thought is not only mediated externally by signs" (or by the help of others), but "is mediated internally by meanings" developed through social interaction. Gagné (1977) brings to light the importance of how the teacher designs instruction in a way that facilitates effortless meaning making. Moll (2001:113) cites mediation tools as "procedures, thought methodologies, and cultural objects that have to be appropriated, practices of discourse and reasoning that have been developed, and play or study practices that have to be exercised". When ICTs are used as mediation tools (to bridge the gap between knowledge and the learner) to make sense of abstract forms, learners' ability to assimilate and accommodate new forms of knowledge or understandings is enhanced to the extent that the actual level of development or state of equilibrium is easily reached even in intricate tasks.

An extension of Vygotsky's concept recognises learner prior knowledge as already established and the learner's cognition is in a state of 'equilibrium' as Piaget states in Ripple and Rockcastle (1964). In such an experience, Moll (2001:114) discloses that "scientific concepts grow into the everyday" and its purpose is to bring "conscious awareness and control". That empowers the learner to be aware and in control of her thought processes in the context of the descriptions of the world leading to the development of thinking or cognitive systems. The instrument used to attain those skills can be referred to as a cognitive tool. In the case of an ICT pedagogical integration that is of value, the teacher can use ICTs as both mediation and cognitive tools to develop the actual level of development so that learners are 'internally' equipped for greater 'scientific' challenges.

Spoken language is the most important mediation tool in a social constructivist learning setting (Powell and Kalina, 2009). It is used as a vehicle for communication in the interaction that takes place during the mediation process. The way language integrates digital technology or any teaching resource for that matter can deem the technology valuable or not depending on whether it (technology) succeeds in garnishing the explanation to promote meaning making. ICTs can enrich the ability of language to connect and present the structure of concepts in different modalities to help make sense of new knowledge.

Vygotsky's account accentuates Laurillard's (2002) argument that the teacher as a mediator plays the key role in this learning development experience. Her emphasis for instance in the teacher in playing his role in the apprehending of structure by interpreting the symbols used in the narrative links with Vygotsky's notion of the use of language in making knowledge meaningful to the learner. Effective teachers in this study make explicit this role and much as the ICT affordance brings value, they diligently play their role as interpreters of the subject representations. The CF demonstrates how through the interaction between the teacher and learner leads to the learner's construction of new understandings. In the next section, cognitive constructivism relates the process that takes place as the learner internalises new knowledge.

Cognitive constructivism

Piaget (1953) initiates his debate on cognitive constructivism by asserting that, for a learner to learn, she or he must be actively involved in the learning process. The involvement entails interaction "between learning and memory, between environment and knowledge" Piaget, as cited in Winn (2003). The external factor is the environment that has the role of presenting knowledge in a meaningful way.

In order to clarify his view, Piaget (1953) contends that children construct a schema internally, through the process of assimilation and accommodation. This construction process begins with the disruption of the schema (disequilibrium) in the event of the presentation of a stimulus or new knowledge. In this case the schema is in "a state of being uncomfortable when one has to adjust his or her thinking (schema) to resolve conflict" (Powell, 2006:27) caused by the incompatibility with already existing structure in the mind. The learner, through assimilation, that is, infiltration of new knowledge into the already existing structure or understandings, makes way for it and eventually accommodates it as his own.

While the schema "provides a context that affects how we interpret new experiences and even directs our attention to particular sources of experience and information" (Winn, 2003:87), that poses a challenge to a teacher whose intention is to help learners acquire specific descriptions of the world. It is for that reason that above organising meaningful material, Laurillard (2002) emphasises the importance of using feedback to identify and rectify misconceptions that come about through this characteristic of the schema as a context. However in his study, Winn (2003:88) concluded that "information shown in picture and graphics is easier to recall because it is encoded in both memory systems, as propositions and as images, rather than just as propositions, which is the case when students read text". This view is contested later in this study by Hudgins (1977) and other

researchers who argue that the image should be interpreted if it is going to make sense for the learner, making the role of the teacher as the mediator eminent.

Piaget emphasises this internal process which Laurillard's (2002) CF incorporate during the interaction in the learning activity. She demonstrates how the learner externalises his or her mental thoughts as he or she gives the teacher feedback during the learning activities. The teacher's feedback helps the learner adapt the structure and eventually establish new knowledge in the reflection process. However, the awareness of Piaget's view of the individual construction of knowledge gives reason to engage diverse affordances from different media to enrich classroom conversation as this process is enhanced. Pedagogical value is therefore determined by the ability of the teacher to create a learning environment that supports presentation of meaningful material that can help learners assimilate and accommodate new knowledge.

Having presented the relevant aspects of the theory (constructivism) that forms the basis for the adopted Conversational Framework in this study, an understanding of what it takes for learners to learn will now be discussed.

What is of value in the learning experience?

Learning is a process where humans "modify their behaviour fairly rapidly in a more or less permanent way, so that the same modification does not have to occur again and again in each situation" (Gagnè, 1975:5). In other words, the change of behaviour and its persistence would be evidence that learning has taken place. In the CF, it is when learners have demonstrated through their adapted feedback that the observer can use as evidence that they have understood. Different media and teaching strategies can be used to solicit this behavior from learners.

On the other hand, Hudgins (1977) views learning as a natural process that is bound to happen in living human beings. His view that this characteristic of humans applies in and outside the classroom, is aligned to social constructivism as it acknowledges the external learning process. In that case the idea of a learner not participating through interaction within or outside the classroom in a learning experience cannot be ruled out as not learning. That means that there are times when a learner needs to be in a motionless state to sup explanations from the teacher and whatever technology is used in the classroom. It may be that at that moment he or she is engaged in intellectual participation as assimilation takes place in the mind. Hudgins explains this as a time

when the learner interprets a text or the class presentation into his or her language or trying to see how and if the new knowledge fits with what they already know.

Learner participation therefore does not necessarily mean responding visibly to a stimulus but it can be that which we cannot see as it is an enclosed organisational structural interaction with old and new knowledge. This leads to a re-organisation or construction of the learner's understanding of the new content based on the way he or she relates it to what is already known. This view relates to cognitive constructivism and Hudgins (1977) supports it by pointing out that at this stage, the learner needs support from his or her environment. He argues that the teacher should highlight what is most important in the content and that textbooks should be organised in such a way that there is a clear distinction between the major principles and the details that support them. He believes the learner organises content to usable forms anywhere even without visible interaction. Although this view stands, it can be based on assumptions that might not be true. For instance, one of the teachers in this study does not use instant feedback from automated assessment to amend misconceptions and he believes that the display of correct answers suffices as information learners should use to adjust their misunderstandings. This assumption can be risky especially when learners do not challenge or enquire about the different responses from the machine as they might remain ignorant of what it takes to learn the aspect of the concept.

Hudgins (1977:4) further suggests that the learner should be given "the information he needs in order to comprehend a concept or principle". This can be in the form of scaffolding, where the teacher provides information that can help learners make sense of the next stage in the development of a concept. The information need not be in a perfect or comprehensive order but part of it can be left to the learner to sort out. Hudgins' premise can therefore be looked at from different angles and that has implications on the teaching and learning process.

In the first instance where learners are not given all the information, that could mean making learners fill in gaps in a presentation with last words in a sentence like in the case of one of the teachers in this study. What is of concern in this case is if by filling in with correct answers they are meaningfully participating in their learning? If they are, what influence does this kind of participation have in the re-structuring of the schema? Does it accelerate the process or does it just facilitate the layering of one plate of knowledge upon the other. This kind of experience gives a picture of one (the teacher) performing a layering or fitting exercise and relates to cognitivist's principles. The learner's role seems to be that of drawing from already present content in the mind and fitting or completing the teacher's statement as evidence that their organisation is in line with

the standard structure from the mediator (the teacher). The content is presented as stimulus and all that the learner does is respond accordingly. The teacher creates the right conditions by providing adequate background or conditions on the subject to prepare learners to give the desired response. What the says is an attempt to jog the internal accommodated structure (in the mind) by recalling and helping to organise or complete the 'puzzle' so that it becomes obvious what the last peace is. In this case, the teacher is interacting with the learners, but the level of engagement on the learner's side is minimal as the teacher has provided enough conditions to emit the right behaviour or response. A description of this kind of learning resembles that of behaviourism where a specific stimulus is presented to produce a desired response to elicit preferred behaviour.

It seems the role that the learner plays in the above scenario from an observer's point of view is similar to that of the last person in a production factory who has not participated in the construction of a product and really does not have to know the ingredients or components and the processes that have contributed to the object that now only needs a seal to complete it. The difference with the case of a learner in the classroom described is that he or she is present in this line of production and is conscious and aware of the process that he is not physically participating in (as the teacher is in control of the process). At this stage, the learner could be aligning his or her thinking with what the teacher is saying and building it to facilitate the presentation of the correct or appropriate cap.

The second scenario is probably closer to that described by Hudgins (1977) and Laurillard (2002) where a teacher presents the major principles on slides, hand out or notes on the board or screen. The gaps created by the teacher are not in the form of objects but are in the process that is taking place. Learners are expected to actively participate in the development of new knowledge. The role they play in this case is visible and seems to be significant in their mental organisation and re-organisation. In their case, the learning environment induces learners to use available internal and external constructs to participate in the construction of their understanding. Hudgins (1977:3) elaborates this phase by saying, "it is the learner who can compare and construct his knowledge, which can juxtapose it and finally array it in a usable cognitive configuration". This process happens in the learner's mind and can be expressed verbally during interactions as she assimilates new knowledge into her internal structure. The final stage is when it is finally accommodated, making sense to the learner. In this case, the teacher does not leave learners to figure out on their own (which might take long) but utilises different teaching methods, engaging various tools as he prods learners towards the completion of the process. Unlike the first case, there is an effort by the teacher to drive learners to the desired destination while in the earlier instance, the teacher gives them substantial matter, and all they need to do is appear and land on the right note.

Hudgins (1977) believes learning should bring about a change in the learner and that it comes as a result of interaction with the environment. How learning takes place is critical in determining whether the learner's behaviour or understanding about life changes. There is a difference in memorising some lines to reproduce them in a test and learning the lines so one can relate them to real life experiences. According to Piaget (1964), there are 2 types of experiences: the physical and the logical-mathematical experience. The first provides the learner with empirical knowledge about the world and the latter is the result of acting on the objects that provide him or her with knowledge about the world. This observation relates to the distinction that Laurillard (2002) makes of every day and academic knowledge. She proposes that the first experience be extended to the later and as that happens, the learner is able to change her cognitive structure to accommodate the 'second order' experience.

How a learning task is organised affects learning and retention. Hudgins (1977) equates this to a filing clerk who organises documents in such a way that it is easy to retrieve the wanted files. If knowledge is not systematically organised, it becomes difficult to remember and apply in a different situation. This organisation should follow a hierarchical order, depending on the level of difficulty and the constructs and constraints of the subject. While this sounds logical, we cannot conclude that such an order guarantees understanding? It is possible that the teacher's order might not be meaningful to the learner during the presentation of structure. The type of interaction suggested by Laurillard (2002) therefore becomes useful as the teacher is able to detect and intervene when this happens. The engagement of ICTs opens opportunities for learners coming from different backgrounds to benefit from the diverse symbols that the teacher might use.

Prior knowledge (particularly that which relates to the new knowledge) also plays an important role in this business of organising knowledge by the teacher (externally) and the learner (internally). The learner is able to see relations of the new with what already exists in their mind. As he or she connects these, he or she is able to make decisions on what is worth using or capturing that will make retrieval of this now extended understanding. Teaching resources can be used in such a way that they contribute to this process. In the case of multimedia for instance, it can be used as topographies that can be used as representatives of these connections.

When a learner is in the process of adaption to accommodate new knowledge, he or she is not passive but active. The way she transforms the structure depends on his or her background as it plays a role in making sense of what has been learned. That is the reason why the reproduction of the information is not verbatim to the original content. Technology can be used to give alternative

content presentations, giving the learner more options to work with as he or she re-structures his or her cognitive structure.

The Cognitive Structure

According to (Hudgins, 1977:29) the concept of cognitive structure is "the formation of knowledge that the learner carries in his head". In other words, the teacher does not copy and paste onto this structure, but theoretically, an extensive and intensive interaction (Hudgins, 1977:29) "with the materials, concepts, theories, and specific information that constitute a branch of knowledge, the closer will be his cognitive structure to the structure of that content". We can therefore deduce that it takes much to have an impact on this structure. The teacher therefore has the responsibility of calling on or engaging what it takes to immerse learners into the 'branch of knowledge' which in this case is the aspect of the subject taught. Possession of Shulman's (1986) Pedagogical Content Knowledge (PCK) becomes necessary if the teacher is to achieve this goal. That therefore justifies why it is important that the teacher knows the learning principles and what teaching strategies to employ at each stage of the learning process. Engagement of the immediacy ICT affordance (Conole and Dyke, 2004) can help accomplish this teaching role.

The learning process

The issue of adaptation that seems to be the consequence for the interaction in the Conversational Framework plays a significant role. In fact, Gagnè (1975) believes once the performance has been modified, then we know learning has taken place. Laurillard (2002:86) demonstrates the same process in her framework by making explicit how this interaction happens in the guidance of the teacher up to the time when the learner is able to adapt her action and eventually "reflect on concept in light of experience". The fact that performance varies depending on the situation they occur from (Gagnè, 1975) is confirmation that this process ends with this individual experience that is displayed in her performance.

The essential incident is when a learner's internal state changes from not-learned to learned and there are events that precede this one that are fundamental to the learning process (Gagnè, 1975). While Laurillard (2002) focusses on the outward show that occurs in the learning experience that results in this phase, Gagnè attempts to display this development of learning within the individual when the process progresses from the beginning to the end. The following 8 phases drawn by Gagnè (1975) are pertinent in making decisions on how and when to execute which teaching strategy or utilise which affordance to make possible the desired learning outcome. They are chronologically

presented, starting with the first event: 1) Motivation phase, 2) Apprehending phase, 3) Acquisition phase, 4) Retention phase, 5) Recall phase, 6) Generalisation phase, 7) Performance phase and 8) Feedback phase.

What the teacher does depends on the phase to be attained. To get learners to retain a concept, teachers can design learning material or say something that would help learners remember or assimilate the new knowledge. It is at this point that teachers' decisions on how to manipulate affordances come into play and at this stage the 'real' (manufacture's instruction) affordance can be unheeded or overpowered by the need to satisfy the demands to achieve this learning phase in learners. Learners are not aware of what is taking place but teachers contribute to some external factors that influence the process of learning (Gagnè, 1975). Other external factors can be motivation, attention, and so on which when combined with everything else in the learning environment constitute procedures of instruction. The use of multimedia and the presentation of multimodal texts have the ability to bring about these external factors and sustain the learning process. There are many other ICT affordances that can contribute significantly to creating learning experiences that support successful learning of concepts.

Conceptual Learning

Concepts are building blocks that help a learner "think effectively in a field" (Hudgins, 1977:111). They can be learnt individually and later related to a principle or learnt as part of it. Concepts "provide classes or categories into which events can be conveniently and productively filed" (Hudgins, 1977:109). To learn a concept, one should have seen or had "direct experience with objects or events that contribute to the concept" (Hudgins, 1977:110). As a rival against knowledge transmission Laurillard (2002) emphasises the need to ground learning of concepts in the experience from which they belong or come from if it will be generalizable and be used as a tool to be used in other situations. The experience does not have to happen during the learning process of the concept. The learning mediator is able to give learners the experience through conversations enriched with appropriate teaching strategies integrated with suitable affordances.

Furthermore, people can have the same experience and yet experience it differently. That leads conflict in communication at all levels of interaction, regardless the context. The level of abstraction is responsible for "the variation in difficulty of concepts", (Hudgins, 1977:110). Feedback and adaptation of understandings are critical if learners are to possess academic knowledge. It therefore

becomes necessary that learners abstract meaning at a higher level if they are to generalise across resolutions for different situations, (Hudgins, 1977 and Laurillard, 2002).

According to Gagné (1970), learning should be organised hierarchically, starting with lower order concepts. Concepts in school are generally abstract and relational and are best learned by connecting them to learn the main or bigger concept. ICT affordances can be engaged to present structure in ways that can make explicit these relationships as different modal texts are called to show the links.

Learning through conversations

Although Vygotsky in particular emphasises the importance of using language in the learning process, the details of how it should be used in a classroom learning context to construct knowledge cannot be prescribed as it is spontaneous. This study therefore finds Laurillard's Conversational Framework useful for its attempt to illustrate the linguistic exchanges that take place during this interaction in a learning environment. Pea (1992:316) believes, "Learning is fundamentally built up through conversations between persons, involving the creation of communications and efforts to interpret communications". Through creation and interpretation, humans interact and as they do so, they negotiate and establish meaning. Communication therefore is not viewed as a one-way process and "a reception of meanings, but as two-way transmission transformational, enabling the progressive construction of meaning through successive turns of action and talk" (Pea, 1992:316). Conversation can play a big role in the construction of knowledge as the teacher guides learners in this process. Pea describes conversations as "means by which people collaboratively construct the common ground of beliefs, meanings, and understandings that they share, and also articulate their differences" (1992:316). Scott (2001:347) argues that the nature of a conversation is such that those involved are provoked "into becoming informed of each other's informing". In the case of a classroom learning experience, the teacher provokes learners to being informed of his descriptions of the world and as the learner participates in the conversation; he or she informs the teacher of what her interpretation is. The teacher then interprets the feedback, adapts his description to help the learner reach the description that is required for the learner to 'act on the world', Laurillard (1993).

Burbules and Bruce (2001:1107) use the term, dialogue for these linguistic exchanges and they argue that they take place in a physical setting. It is interwoven and occurs "simultaneously with other activities". This notion alludes to the view that the use of ICTs as tools cannot be studied in isolation in the physical setting of a classroom (Dron, 2012). Laurillard (1993), through her

framework, attempts to bring attention to this complexity that occurs as ICTs are used in the classroom. Although her engagement with this concept is based on her studies of university teaching and learning, the fundamental discussions on the concept is generally the same at any level of schooling. Her relevance in this study is based on her belief that ICTs play a role in the enhancement of the effectiveness and outcome of these conversations.

Learning through processes of appropriation and interpretation

In his attempt to try and understand the influence of classroom dialogue in learning, Pea (1992) explains the enculturation into the scientific community by suggesting that there are 2 central mechanisms that underlie this process related to talking science. The first one, he refers to as appropriation and the second central mechanism is meaning negotiation. Only the second one is discussed as it is relevant to this study. Its structure "consists of reciprocal acts of interpretation between speakers" (Pea, 1992:320). The resources for meaning negotiation are many and some of them are as follows: "requests for clarification or elaboration, gestural indications of misapprehension, explicit paraphrasing of what-may have-been-meant to test for understanding, and explicit commentaries" (Pea, 1992:320). These verbal resources may not be adequate and it is such a time that other teaching resources can be engaged. The advantage of using ICTs is in their immediacy, multimodality, adaptive and ability to produce effects that can enrich the teacher's conversation in a moment, particularly if the user is proficient in engaging them in the classroom dialogue.

To support meaning negotiation, Garfinkel (1967), an ethno methodologist argues for indexical support. These help the speaker to "opportunistically use the resources of a physical world to clarify what they mean, given the ephemeral nature of spoken language. Their words are indexed to referents in a situation, such as words or symbols on a whiteboard or computer screen". So these symbols and other representations are brought in to actually help the speaker in the negotiation of meaning. "Such indexing is critical for establishing shared semantics of representations, referential mappings between situations and formal symbols depicting world entities" to establish a common ground (Clark and Shaeffer, 1989; Clark and Wilkes-Gibb, 1986) This is when at times cultural artefacts or local experiences and in some cases learner mother tongue is integrated into the language of learning (code-switching) as meaning is negotiated.

This discussion has attempted to address issues about learning that are mostly related to learning experiences observed from the participating teachers' practices. Through engagement with literature, better understandings and descriptions used in the presentation of data have been gained.

The next section focuses on the learning environment that can help support these learning experiences.

The Learning Environment

Learning is activated by stimulations from the learning environment. "The stimulation is the input to the processes of learning. The output … is a modification of behaviour that is observed as human performance" (Gagne, 1975:49). This implies that whatever is brought in by participants in the learning process should have an impact that leads to visible behavioural change. In the context of the CF, it is the learner feedback that discloses this modification, whether desirable or not. If the learning environment therefore does not promote this visible show it becomes difficult to assess the value it has contributed. In a case where negative feedback or the output is received through a media the misconception can be adapted to suit learning goals to the benefit of the learning process.

The type of environment that is created depends on the teacher's teaching approach, his intentions for the learning experience and the nature of the subject. Laurillard (2002: 48) argues that "Academic study cannot do without special forms of representation-language, mathematics, diagrams, symbols…" but how learners make sense of them determines the success of the learning process. The teacher's role in creating a learning environment where the interpretation of these symbols can be accessed becomes critical. Although spoken word can be used to accomplish this task, multimedia and non-linearity can be engaged to augment it. In addition to that, it is "the design features that invoke successful learning activities by the students", (Laurillard, 2002:190). As already been highlighted, it is important therefore to highlight what is important in a text and to present it in a logical order as that helps learners remember (Meyer and McConkie, 1973). In the presentation of the content structure for instance, it is important that the learner pays attention to relevant aspects in the development of the concept and the teacher's role is to assist learners to know what they should attend to through the teaching material design. The use of different modal texts on a slide for instance can help achieve this role.

Materials should be designed in such a way that they are meaningful to learners. Although there is no guarantee that they will be meaningful to them, they should be able to relate it to other ideas already stored in their cognitive structure (Ausubel, 1968). It is therefore important that the teacher closes the gap through interactive media which includes the spoken word to relate to it. Therefore it is risky to the learning process to neglect making the links between what is known and new knowledge. The other condition is that the learner needs to adopt a "meaningful learning set" to learn to learn it (Ausubel, 1968: 50). The package is viewed by Laurillard (2002) as the application of what is learned as they practise it in given tasks. In other words, learners should be given an

opportunity to practise theory in practical situations to help them adapt their understandings to new concepts. Hyperlinks to adaptive media like simulation can be used to help learners experience or participate in real world scenarios in the classroom. Classrooms with no internet connectivity cannot have this experience, unless they are technologically savvy to maximise the utilisation of functions in available applications. The question therefore is, what innovative ways can be adopted and utilised by novice teachers if their learners are to have the same experiences through the teacher's use of unconnected digital technology.

Hudgins (1977) makes explicit what meaningful material is by saying, "It represents something or some idea". The difference here is that a link has to be made between the representation and the idea or concept through mediation (Laurillard, 2002). At lower levels of learning, "this referent can be concrete, but at secondary level, learners should be able to comprehend abstract connections in concepts", (Hudgins, 1977:30). However, this does not follow, especially where there are contextual learning barriers like learner limited language of learning and teaching (LoLT). However, links with experiences they are familiar with through engagement of multimodality can alleviate the impediments. The concept of *radiant* for instance has the same implication in mathematics and in physics and referring to its descriptions in one subject would help make meaning in the current one.

If not meaningful, materials are learned by rote and the disadvantage with such resources is that they "diminish sharply in the minutes and hours immediately after acquisition" (Hudgins, 1977:33). Cramming for examination does not work for long term retention but for short as the memory undergoes decay after a short time. It is therefore important to determine if materials make sense or not through interaction between the learner and the teacher. Other teaching methods can then be engaged to remedy the situation. The immediacy of ICT affordance becomes handy in such cases (Conole and Dyke, 2004) in giving instant feedback that can disclose learner misconceptions. In cases where learners do not have access to digital media it becomes a challenge especially when the whole class input is needed to adjust teacher descriptions.

Laurillard et al., (2000) extends this subject by including design features as properties of a technology affordance and that they are critical in determining the effectiveness of media use. They highlight the title, sub-headings, connecting phrases and other features as significant in establishing the structure of the content. Later, they bring focus to the responsibility of the teacher and the designer by taking into consideration what "kind of learning activities it takes to understand a topic, and then create the affordances for those activities" (Laurillard et al., 2000:17). In the classroom interaction, as the teacher makes decisions in his preparation for the lesson, each component has its

role to play, based on its affordance. If each component, digital or non-digital possesses a desired affordance it can enhance the learning experience. This accentuates Dron's (2012) argument that pedagogy is an orchestration of all that happens in the classroom that makes possible the achievement of educational goals.

In the description of the world that Laurillard (2002) refers to in her reference to academic learning, she emphasises the need for learners to experience the concept they are learning. In this Jonassen and Rohrer-Murphy (1999:69) suggest the learner should be enabled to "construct conscious models of how it functions." They also believe, the more experiences the learner has, the higher the probability that they will learn through the activity. Novices lack experience and in the case of Constructivist Learning environments (CLEs), it is important to provide learners with these and in a case where it is not possible, ICTs can be used to bring those into the classroom.

Learner-Centred Environments

Such environments pay attention to the "knowledge skills, attitudes, and beliefs that learners bring to the educational setting", (National Research Council, 2000:133). If that is to be taken into consideration, the learner's background becomes critical in the development of new understandings (Laurillard, 2002). Teaching then becomes culturally responsive, culturally appropriate, culturally compatible and culturally relevant, (Ladson-Billings, 1995). The selection and use of ICTs of one of the teachers in this study for instance seemed to be a result of his awareness of his learners' weakness in the LoLT and he believed it was a barrier to their understanding of the subject matter. This brought pedagogical value to his use of ICTs as he claimed their performance improved.

Diagnostic teaching is also relevant in this case (Bell, O'Brien and Shiu, 1980). It begins with the established structure of knowledge of the learner (schema) and utilises questioning, observation, conversation and reflection on the learner task activity. Teachers need to help learners develop these structures by making them explain and predict situations they are presented with cognitively. Instead of focusing on correcting misconceptions, teachers can present activities where learners can test their misconceptions, (Bell, 1982a; Bell, and Purdy, 1985). Engagement of collaborative activities can be used to achieve this outcome. The idea is to set learners up for cognitive conflict and open spaces where these can be dealt with (Piaget, 1973).

Part of recognising learner existing knowledge is to know and link their cultural backgrounds into classroom learning. In a study of Hawaiian children, Au and Jordan (1981) discovered that when teachers shifted focus on decoding to comprehending by including cultural home experiences as

part of the discussions on the reading materials, learners improved their performance in reading. In fact, one of the mathematics teachers in this study expressed how he acknowledged the use of learner every day experiences in the sponsor materials and he believes after adopting the same approach, his learners' level of understanding complex concepts improved.

It is important that learner-centred environments take into consideration that "learners construct their own meanings, beginning with the beliefs, understandings, and cultural practices they bring to the classroom. If teaching is conceived as constructing a bridge between the subject matter and the student, learner-centred teachers keep a constant eye on both ends of the bridge" (National Research Council, 2000:136).

Teachers should therefore understand and show respect of learner prior experiences and learning as these can be used (Duckworth, 1987) as "foundation on which to build bridges to new understandings", (National Research Council, 2000:136). Laurillard (2002) extends this view by arguing that teachers ought to know how their students think, otherwise, their efforts are as good as building on sand. In the case of this study, the teacher, through classroom dialogue is able to draw from learner prior knowledge and use it to build the bridges. Media can be used in multicultural classrooms where prior knowledge might differ and therefore bring all learners to similar levels of understanding.

Knowledge-Centred Environments

It is knowledge-centred environments that help learners become knowledgeable (Bruner, 1981) and as such lead them to understanding and consequent knowledge transfer. The engagement of ICT affordances in providing these well-organised knowledge bodies particularly at the narrative stage, would alleviate the teaching and learning experience.

Effective knowledge-centred environments merge with learner-centred environments when teaching begins with recognition of prior learning about the subject taught. It becomes difficult to predict what learners will understand if the knowledge they come with is not taken into consideration, (National Research Council, 2000; Laurillard, 2002). It goes without saying that classroom conversations play a big role in establishing the nature of learner prior knowledge and connecting it with new understandings.

Knowledge-centred also implies helping learners develop metacognitive skills by expecting new knowledge to make sense and querying what does not make sense. Scheffler (1975) argues that

most curricular advocate for a process where there is calculation involving routine which does not incorporate "ingenuity or flair, no place for guess work or surprise, no chance for discovery, no need for the human being, in fact" (Scheffler, 1975:184). In a way that may limit the perceptions and engagement of digital media forms that may have potential to develop thinking skills required in a field outside schooling.

Conclusion

There is a need for the teacher to consciously create environments that promote meaningful learner participation during the learning process if learning is to be advanced. There is evidence from literature that the role of the teacher (as a mediator or the one bridging the gap between learner and academic knowledge) does not diminish in the presence of ICTs, but should be enhanced by their presence.

What is of value in teaching with ICTs

As already been indicated in the introduction of this review, the phenomenon to be investigated in this study is teaching. Laurillard develops an argument for the significance of classroom conversation in the construction of learner understandings with the guidance of the teacher as the mediator or facilitator of this process. Her view of the teacher's role is what this study attempts to foreground in the context of ICT use in the classroom.

Laurillard's description of what teaching is alludes to Ramsden's (1992) who views it as a conversation of some kind. She therefore argues that it is a dialogic process, a "rhetorical activity, seeking to persuade students to change the way they experience the world through an understanding of the insights of others" (2002:43). It has already been established that the teacher creates an environment that can alleviate the assimilation process in order to accelerate learning. The teacher therefore needs to engage means to resolve this task (Laurillard, 2002) and these include teaching methods and resources all brought in to enhance this rhetoric activity. The learner is not so much the recipient, but as constructivists believe, he or she participates in the learning process.

In the beginning of her book, Laurillard (2002) contends with the idea that teaching is imparting knowledge. She alludes to Ramsden's view that teaching "is to make student learning possible" (1992: 5). This belief places a lot of responsibility onto the teacher where understanding learner learning and what makes it happen is concerned. She describes that role as mediating learning, and

it entails “allowing students to acquire knowledge of someone else’s way of experiencing the world” (Laurillard, 1993:29).

Laurillard argues that teaching as mediation of learning “involves constructing environments which afford the learning of descriptions of the world” (1993:26). Everyday knowledge is accessed directly and academic knowledge is mediated. Since academic knowledge’s construction is based on everyday concepts, it relies heavily on symbolic representation as the medium through which it is known”, (Laurillard, 1993:27). These representations consist of what Vygotsky refers to as mediation tools and above all of them, he acknowledges language as key to this process. It is through language that the teacher is able to orient the learner into these descriptions that are situated in specific disciplines, for example, mathematics symbols, diagrams, musical notation, phonetics, or any symbol system that can represent a description of the world and requires interpretation”, (Laurillard, 1993:27). Some of these symbols are too abstract for the teacher to represent spontaneously as he explains and yet with the use of ICTs, this can be achieved with a click. Through dialogue, the teacher uses an integration of these representations to help learners make sense of the interpretation of the world (subject content).

The teacher’s role in interpreting these symbols is important especially if learning is to the extent that transfer is possible. Laurillard (2002:72) argues that there is “no escape for the need of a dialogue”. Whatever tool or media is used therefore need not remove the role of the teacher in the process. If excluded, learners operate at a localised level, the overall structure (content) remains inaccessible and the overall meaning is in danger of being lost. Teaching and learning scholars generally do not foreground the significance of this element that Laurillard emphatically presents. However, she does not cover much ground on the importance and the unavoidable role played by the rest of the pedagogical ensemble that contributes to the success of the learning process that Dron (2012) refers to. However, Laurillard’s focus seems to be on making visible the contribution that media makes to learning.

According to Webb, (2005:705), the “crucial component in the use of ICT in learning and teaching is the teacher and their pedagogical approaches”. It is therefore important that the teacher is aware of learner alternative conceptions, identify the appropriate affordance and to evaluate them in relation to learning activities in the classroom. Integration of these components therefore has to be part of what the teacher has already been doing effectively anywhere.

To emphasise the idea above, technology should only serve as a catalyst and not an additional resource that does not add value to the teaching and learning process. That then challenges Hawkridge's, (1990) and the South African ICT in education policy, The White Paper on e-Education's (DoE, 2004) speculations that consider ICTs as catalysts for change in pedagogy. It should be acknowledged that, before the technology is brought in for instance, the teacher is already making an impact in changing the behaviour or lives of children through conversation and skilful integration of other non-digital technologies. The power of what the teacher has initially must not be underestimated and yet it is important also to appreciate the power of digital technology in strengthening and augmenting what is already making a difference in the teaching and learning experience.

As already been mentioned in the affordances section, Wenger (1990) describes how the role played by ICTs should appear in action. He proposes that technology should be visible as a learning tool and yet invisible as a mediation tool. Its visibility would be felt in the impact it has on the learning experience as teachers for instance enrich their development of concepts they are teaching. The invisibility is caused by the fact that the main focus is in the mediation process (what the teacher is saying, how he is saying it, based on his knowledge of the learners, the subject, curriculum, beliefs about teaching and the mediation tools he engages) and the development of the learning process, and not on the single tool. For instance, when a geography teacher is showing how a type of mountain is formed as a result of a volcanic action, the way the video is integrated would enhance learner understanding if its contents illustrates, confirms or emphasises a point that the teacher is making on the concept in a particular moment. The video therefore does not become the focus in the lesson, but its significance is in its contribution to the understanding of an element in the construction of the bigger topic of extrusive land forms. The style of media use in the context described above demands teacher ICT or media use aptitude that can produce the desired learning outcomes in the Conversational Framework.

In addition to what a teacher needs to know, the following aspect about learning enriches the understanding about the impact media can have in a teaching and learning experience:

Apprehending Structure

Understanding structure is not easy because of its complexity and the fact that it is rarely explicit. Learners are expected to "interpret correctly a complex discourse of words, symbols, diagrams, and pictures, all bearing a specific meaning that must be interpreted correctly if the student is to learn

what is intended" (Laurillard, 2002:51). Learners usually fail to interpret the structure and the teacher's role is to decide "on the structure and how it is to be displayed as part of his instructional strategy…" (Laurillard, 2002:51). That should be followed with tutoring on how to interpret the symbols used during the rhetoric. It is then that non-linearity can be useful as the teacher engages different media to enhance understandings. Burbules and Bruce, (2001:1112) contend that, "teachers will need to see themselves more as guides and interpreters, not as source of authority". Teachers are guides in the sense that they direct learners into reaching educational outcomes by focusing on the 'process' as the programmer teacher indicated. As this process is concretised and the interpretations presented, the presence of ICTs in the pedagogical constituent can then be considered of value.

Using Feedback

Although the learner should be active in her own learning, "Action without feedback is completely unproductive for a learner" (Laurillard, 2002:55). Connecting action and feedback, results in some form of learning. Feedback must be meaningful so the learner can adjust action. There is intrinsic and extrinsic feedback. Both are important in the learning process.

Feedback is external if it is from the context of action and operates at the level of descriptions of actions. Good extrinsic feedback gives learners information about how to adjust their performance. As the interexchange occurs between the teacher and the learner, the feedback is situated in the dialogue (outside of the learner). The dialogue gives "further opportunity for action in the form of description" (Laurillard, 2002:63) and the descriptions of the world are modified. Intrinsic feedback is that which is experienced by the learner directly and extrinsic is in the form of descriptions given by the teacher in this case. As the teachers get feedback from learners with indicators of where intervention is needed or not, they decide whether the resources used were adequate or not and if not, from their repertoire of strategies, engage resources of affordances that can help successfully deal with the misconception. ICT affordances have the advantage of being flexible as materials can be manipulated to satisfy the learning need.

Using questions

Although Laurillard (2002) in the conversational framework does not engage much about what the interaction involves, question and answer for feedback from both teacher and learner contributes significantly to this classroom dialogue. Questions can be used in two ways, (Gall, 1970). First, they can be used to "interpose one or more question into text material on a systematic and frequent basis" (Hudgins, 1977:73). In this case, the questions are based on content presented to facilitate

understanding. They help to make the leaner focus on what is important in the reading and thus gain more understanding than if questions were asked after the reading. The immediacy of ICT affordances in this case can help revert to previous material if there are some misunderstandings. Secondly, questions can be asked before study to raise interest about what is about to come. When content is displayed, even with meaningful material, the teacher could use questions to help leaners make sense of it. Questions therefore come handy as they help learners pay attention to parts that help formulate answers in the new content. In general, questions play a key role in eliciting feedback that can be used to make decisions on directing the pace and direction of the lesson as the learning develops.

Using pictures

According to Laurillard (2002 it is common that educators begin with concrete examples when teaching concepts, but quickly warns that the way this is done determines its effectiveness in helping learners understand. In other words, pictures on their own, without a teacher or someone to explain them do not improve learning.

In Dwyer's (1967) study where he only presented different pictorial presentations (oral, abstract linear, detailed shaded drawing and realistic photographic) to test the level of proficiency in a) Heart Model, 2) Drawing, 3) Terminology and 4) Comprehension, found that from the instructional point of view the abstract line drawings were as effective as other forms although in some cases the most effective. This suggests that highly realistic presentations may be too detailed for an audience that is 'untutored' and intellectually unsophisticated, making learning more difficult for a novice learner (Hudgins, 1977:88). In the case of one of the geography teachers in this study, she used different forms of representations (drawings and graphical illustrations) together with the pictures to explain concepts. However, each seemed to have its own affordance that contributed in enabling clarification of a point. Explanations in the conversation with different representations of the same feature could then help curb Hudgins' concern and enhance learner understanding.

The following studies emphasise the ineffectiveness of pictures as symbols in the absence of conversation in a learning experience. Vernon (1954) carried out a study where she investigated the influence of pictures to understanding and remembering of children between the ages of 11 and 12. She discovered that pictures have a minimal influence in understanding and remembering text passages. Miller (1938) investigated the influence of pictures on the reading of learners in the first 3 grades for the length of a term. Half of the children were given readings with illustrations and the other half read the same series without. He found that both groups performed the same. To justify

these findings, Farnham-Diggory (1972) emphasised that children do not operate with diagrammatic material beyond their cognitive development. These studies prove that pictures do not enhance understanding, more so if the instructional or mediation role through conversation has not contributed to the interpretation of these symbols that represent "descriptions of the world". This is evidence that the impact of ICT affordances can only be possible if they are integrated into the classroom conversation.

Aesthetic features in an image do not add value to the learning process. In another study cited in Hudgins (1977) for instance, May & Lumsdaine (1958) investigated the use of motion pictures (or television) in the classroom. They discovered that children expressed the same interest in both black and white and in colour films. A narration of the same film with film characters was more favourable. This evidence proves that aesthetic qualities of images do not add value, unless they contribute to the understanding of the concept taught. Interpretations of these representations become significant during the classroom conversations if learners are to meaningfully engage with the content delivered.

Adaptive media form like a film or video also need mediation if they are to be of influence in the learning process. May & Lumsdaine (1958) carried out a study that investigated the role of questions in Grade 10 and 11 learners. In order to demonstrate the importance of mediation in making use of film for teaching effective, they asked 2 types of questions – motivating and participating. The motivating one came before a part of the film to arouse the learners' curiosity. Participation questions followed parts of the film and this was done while the film was posed temporarily. The results showed that responses for both types of questions, individually and collectively were better than just giving learners to simply view a film. Conversations used to guide learners on what to look for or listen to give value to this media affordance.

Conclusion

The Conversational Framework gives reason for the teacher to 'teach', and for that reason, credit cannot be given to technology on its own. In all this, the teacher has the upper hand in designing and conducting the learning process so that all works seamlessly to enhance the learning experience. Even with the presence of all these aspects, as long as the combination is not skilful and innovative enough to help achieve the learning outcomes, even 'beyond expectation', the process can be of no pedagogical value. Wood (1998) supports this notion by arguing that the success of ICT integration depends on how the teacher's overall pedagogy is integrated in the classroom strategies.

In-service ICT teacher preparation

Teacher e-readiness has been considered as key in the uptake of ICTs for teaching, and yet its implementation has not been given the attention it deserves considering its complexity. A study by Moseley et al., (1999) for instance looked at specific ICT uses in the classroom and concluded that teachers need to take into consideration a number of issues that include the following: teacher development in teaching styles and approaches; "a planned match of pedagogy with the identified purpose of ICT activities and learning outcomes; and clear identification of how information and communications technology will be used to meet specific objectives within subjects of the curriculum to improve pupils' attainment" (1999:388). While the role of ICTs should be significant, it only serves to enhance the teacher's explanation, the understanding of the task, concept, amongst many other things - whatever contributes to the learning experience and what it seeks to achieve.

Marx et al. (1998: 389) developed a conceptual framework for professional development with the following three categorisations of the applications: multimedia; productivity tools; and information and communication systems. The problem with this ICT training content is that it appears to focus on technology skills and does not show how these abilities would have benefited which aspect of teaching as suggested by Mosely et al. (1999) above. The assumption can therefore be that the teacher would automatically make the appropriate decision on where and when to engage them in his teaching. According to Laurillard (2002), the productivity tools for instance would be used by learners to articulate individual understandings of concept taught.

McCormick and Scrimshaw (2000) suggest three approaches which indicate a possible spectrum of use of ICT and the implications for teachers' pedagogy which are: to improve teaching efficiency; to extend teaching and learning and to transform conceptions of subject. The interpretation of these pedagogic forms is that they can be misinterpreted to support technologically oriented teacher behaviour as they use ICTs in the classrooms. However, Leach and Moon (2000) believe the three forms of pedagogic use presented above cannot be implemented in word processing or for PowerPoint presentation purposes. This study would like to argue that it all depends on how each of these applications is used in the conversations that form the teaching and learning process.

It is evident therefore that teacher ICT in-service training that concentrates on technical skills and neglects guidance on how these abilities can be integrated into already existing pedagogical components is not adequate to prepare teachers for substantial usage of the technologies. Teachers talk in the classroom when they teach and unless the training makes explicit how and when to make

decisions in their classroom conversations to infuse digital technologies, they will continue to find them cumbersome to use for teaching.

Classroom dialogue

In the classroom, teachers guide the conversation as they play their role as facilitators (Laurillard, 2002). Through this activity students can be guided into discovering insights on their own (Burbules and Bruce, 2001). The dialogue is seen either as a "pedagogy that is egalitarian, open-ended, politically empowering, and based on the construction of knowledge, reflects only certain strands of its history – contemporary vision". Contrary to this view, they see it as "a way of leading others to performed conclusions, or as a way for a master teacher to guide the explorations of a novice or as a set of ground rules and procedures for debating the merits of alternative views or as a way to frustrate, problematize, and deconstruct conventional understandings" (Burbules and Bruce, 2001:1102). It is clear therefore that classroom conversations constitute what makes learning take place and thus is driven by the interaction, the methods and resources the teacher uses in the process.

In a way, dialogue is not the only media form that operates in this context. Burbules and Bruce (2001:1103) argue that, "It is manifested through a range of texts and other mediating objects (for example, notes passed between students, bulletin boards, or dress codes)". This implies that a dialogue does not only constitute speech, but all that is used in the classroom to communicate a message (Romiszowski, 1988). This is true especially "when dialogue is understood to include a range of communicative acts, gestures, or facial expressions, and is not limited to spoken words" Burbules and Bruce (2001:1104). In fact, presentation of different types of texts plays a big role in the teachers' conversations in this study's classrooms. The discourse then serves to make the connections of all these items to help learners make sense of the content.

When ICTs are used or any technology for that matter in the context of an on-going dialogue, they become part of the classroom dialogue. Burbules and Bruce, (2001:1103) make this relationship clearer by arguing that, "These relations among discursive (conversational) practices, other practices and activities, and mediating objects and texts are not simply interactions among discrete social factors; they are dialectical relations among elements that mutually constitute one another". When teachers proclaim that ICTs make it easy for them to teach, they therefore mean that they help enhance these relations to the extent that their learners can make sense of academic knowledge and that leads to their improved performance.

There is an element in the used ICT affordance that makes the mediation process or the dialogue effective. "The nature of the relations fostered by particular forms of verbal interaction may be utterly unpredictable from the actual intentions and purposes of the agents concerned" (Burbules and Bruce, 2001:1103) and yet what counts, is the effectiveness of its contribution to the ensemble. The teachers' decision making to bring in an ICT affordance depends on the need at the moment to enrich their argument in the dialogue. It can therefore not be expected to be in the form of a pattern, but rather an innovative or skilful aspect in their practice that enables them to timely engage the ICT affordance to explicate their point. It seems the ability to be flexible in one's thoughts and being able to turn a difficult situation by impulsively incorporating whatever is at one's disposal to alleviate the complexity is the teacher's attribute to be valued.

Burbules and Bruce, (2001:1104) also consider discourse as the glue that holds interactions together. It is the classroom dialogue for instance that makes the contribution of any other form of text presented in any media, make sense. Above that, Laurillard (2002) seeks to show how through classroom conversation, learning can be developed to the extent that learners can construct their own understandings. The dialogue threads and connects every element of the dialectic process taking place in the classroom and as it does so, it engages different modal texts and artefacts that help learners visualise and make sense of the new knowledge.

Burbules and Bruce, (2001:1105), describe the interaction between the teacher and the student in a dialogue as an "active partner in the teaching-learning process" and this is best represented in the structure of the Conversational Framework. Before teachers proceed to the next phase in the development of a concept, they get feedback from learners and based on the response, they reflect and adapt their conversation or descriptions. In a way, learners go through the same process and both the teacher and the learner use feedback for the development of the process.

Lankshear (1997) acknowledges the way discourse theory has made explicit the influence the form of media has on conversations are perceived. It is possible that the ICT affordances in a way influence the teacher's conversation and by so doing bring out aspects of concepts taught that would not have been easily articulated without digital technology. Selfe and Selfe (1994) describe how the computer interface as any complex technology asserts what it represents in terms of the designer's culture and ways of communication that the user unconsciously adopts. The user's language and conversations are inevitably shaped by the computer interface as a consequence. It is therefore important to examine how teachers' use of ICTs mediates and influences ideas in the classroom.

Conclusion

With the influx of digital technologies, education institutions strive to acquire these resources with the hope that teaching and learning would be improved. The emphasis in classrooms of this study is on how teachers carry out the dialogue in such a way that learners have similar descriptions as those of the teacher through the use of ICTs. That is done differently per teacher and the affordances engaged seem to depend on teacher or learner needs. They have information, but their concern is presenting it in such a way that makes it clearer, even clearer than the text books (the programmer teacher). They are supplementing available resources and perhaps that is the reason they value the affordances that come with ICTs as they make this possible.

Based on the literature reviewed in this study, it seems the teachers' knowledge about teaching and learning plays a big role in making decisions and in the actual integration of ICT affordances. It is also important that teachers know the limitations of the affordances they engage so their utilisation can bring more value to the teaching and learning process. Whereas an understanding of what is of pedagogical value is eminent, knowledge of what determines its implementation within the teachers' influence is essential for this study. The next section will therefore examine the relationship between teachers' espoused and enacted practices.

Espoused and Enacted Practices

This study is using espoused and enacted practices to investigate what is of value in the use of ICTs by participating secondary township teachers. A number of studies have proven that there is a link between espoused and enacted practices. What seems to inform this view is the argument that, pedagogical beliefs have a strong influence on how teachers integrate ICTs into their teaching (Ertmer, 1999; Fulton and Torney-Purta, 1999). This forms the main idea for this section as factors promoting this effect are discussed to help understand the relationship between these two teacher practices. The term used for espoused practices in some literature is 'beliefs' and in this study that relates to the data collected through interviews as teachers expressed their perceptions on their use of ICTs in the classroom.

Teacher beliefs are formed in different ways. They may be formed as a result of a successful or unsuccessful teaching experience, an experience as a learner or teaching practice while a student teacher (Kurz-McDowell and Hannafin, 2004). The sooner they are formed, the more difficult they are to change (Pajares, 1992). For instance, teachers' pedagogical beliefs that have been established over years on their practice would not easily change because a new technology has been introduced.

Ertmer (2005) has categorised teacher ICT adoption barriers into two: the first order (external) and the second order (internal). She describes external barriers as those that are beyond the teacher's jurisdiction, and the internal as beliefs about teaching and learning. She believes it is difficult to change teaching philosophy and as a result they are likely to be manifested in their teaching. According to her, interventions to promote ICT integration tend to focus on first order beliefs as they can be remedied. Because second order beliefs are stronger, Ertmer (2005) believes, they are inclined to have more influence on the adoption of technologies than the first order beliefs. This is evident in the teachers participating in this study that have adopted and adapted the technology despite unfavourable circumstances they teach from.

However Zhao and Cziko (2001) place teachers' technology beliefs at a lower level goal than their pedagogical beliefs and teaching approaches. They claim lower-level goal beliefs are easy to vary and Pajares (1992) adds that newly acquired beliefs are easy to change. Although ICTs have been introduced in educational institutions, teacher belief goals on these technologies are still at a lower level, especially for those (teachers) teaching in less resourced schools. That being the case, the belief goals would have an impact on teachers' level of adoption and utilisation of these digital technologies.

Other barriers that seem to influence the extent to which ICTs are adopted or integrated are curriculum pressures (Jonassen, 2000) and inexperience with the technology (Kurz-McDowell and Hannafin, 2004). These barriers tend to restrict integration to lower cognitive levels of engagement where learners are exposed to drill and practice or huge amounts of content that they are expected to 'consume' within a short time. Furthermore, Seymor (1980:75) argues that drill and practice alienates "the child from his own thought process as well as from the true nature of Mathematics"

Bandura (1997) and Schunk (2000) emphasise the importance of building teachers' confidence in using the tools as a priority over the introduction of more challenging experiences. The importance of gaining confidence cannot be over emphasised as that is a prerequisite for creative use of ICTs in this complex classroom environment. The teacher is able to draw from ICT affordances to support his conversation when he knows where to find what, when to bring it in seamlessly and how to operate the machine. That could be the reason why teachers in this study did not need any technical staff in their lesson presentations. Nevertheless, the fact that a teacher has confidence in using a technology does not necessarily mean his teaching beliefs on teaching and learning will change. It does promote an enriched classroom conversation though. The perceptions of those who have just adopted the teaching approach like the teacher for School B in this study might still be influenced

by acquired principles received during ICT use orientation and might not be at a stage where they can implement or reflect them in their teaching.

Through comprehensive use of technology, access, training and support, they can be transformed, (Dexter, Anderson and Becker, 1999; Elmore, Peterson and McCarthey, 1996; Windschitl, 2002). Becker (1998) presents three possible theories that could explain the link between using technologies and teaching beliefs. The first one is what he refers to as Theory of Technology – Induced Belief Change or the Trojan Horse. In this case, computers encourage and require changes in practice that lead to change in pedagogical beliefs as they use technology. Affordances make possible opportunities that the teacher had not imagined before that actually makes his practice more effective. The second theory Becker proposes is the Theory of Facilitating Conditions. Computers become a catalyst that supports changes in teaching that match pre-existing personal philosophies and make it possible to put them into effect. This could be the case with some of the teachers in this study who claim their learners' performance has improved since they started using computers. Some report that their Matriculation results have gone up by more than 50%. The third one is the Theory of Spurious Correlation where computers do not have much impact as the teachers are innovative by nature and it is in them to try new ideas. In the case of the programmer in this study, his computational thinking skills enable his spontaneity as he tries to solve the pedagogical challenges he meets in his classroom.

Ertmer's (2005) assertion that teacher beliefs do not translate into actual teaching is supported by theories of action. There are 2 types of action theories: espoused theories of action and theories in use (Argyris, Putnam and McLain Smith, 1985). When explaining intentions of a certain action, people often tend to respond with their espoused theories of action, not with actual theories in use.

When considering espoused and in use theories, we need to take into account the underlying beliefs and actual practices. Riel and Becker (2000) discovered that teachers' use of ICTs is closely related to their ability to translate their beliefs into teaching practice. This could mean that limited beliefs be gets limited use as in the case of the geography teacher in School E. On the other hand, Windschitl and Sahl (2002:198) discovered that "the technology did not initiate teachers' movements toward constructivist pedagogy". This relates to the case of two teachers in this study, who use traditional methods of teaching regardless the availability of ICT affordances that could transform their practice.

The reasons for ICT use that are not aligned with teachers' pedagogical beliefs can result in compromising effective teaching and learning. For instance, Angeli (2004) discovered that misconceptions or simple views and beliefs become obstacles for the development of Technological Pedagogical Content Knowledge (TPCK). He found that pre-service misconceptions about ICT use for teaching and learning such as the belief that ICTs a) promotes passive learning b) isolates children from the social milieu c) limits children's fantasy and creativity d) provides canned knowledge were a barrier.

These negative misconceptions could have can about as a result of perceptions based on limited knowledge about ICT use or empirical evidence based on usage that is not inclined to giving pedagogical value to the experience. In some cases, ICT actual or real affordances (as per manufacturers' advice or intentions) may clash with teachers' theory in use, or they may not be in their realm of perceived affordances. In some cases, the promises made about ICTs are drawn from research results from distinct contexts that may not be repeated in other environments. Some give the impression that ICTs have powers that supersede that of human beings whereas when implemented with no consideration of the user's context in terms of subject demands, resources, cultural differences and learner needs, different and at times undesirable outcomes may emerge.

In a study by So and Kim's (2009) that involved student teachers who worked in pairs from English, Science and Mathematics to apply Technological Pedagogical Knowledge (TPCK) in a lesson, the knowledge received emphasised complex interactions amongst these three knowledge domains (technology, content and pedagogy). The study's aim was to help pre-service teachers develop a firm base of TPCK by observing them apply their learnings on Problem Based Learning (PBL) in their preparation for an ICT integrated lesson. Although accuracy of content knowledge was not examined, the students still could not have what it takes to apply TPCK.

The results showed that these pre-service teachers "tended to use technology as a mere delivery medium rather than an instructional tool supporting cognitive activities" (So and Kim, 2009:8). The designs consisted of mainly low order thinking skills and the presentations were linier. The complexity that goes with developing material that support cognitive activities with technology needs to be rooted in the depth of the teacher's understanding of the topic, how learners learn and how best to represent subject matter in a way that would help them easily grasp the concept. Although experienced teachers can operate at the same level of ICT integration, the nature of the conversation and the inclusion of other resources should be rich enough for learners to have similar

engagement with simple low level utilisation of technology. This study argues that for a technology to be an instructional tool it ought to be playing a particular role that helps to enrich an existing PCK.

The students also struggled with knowing the boundaries of teacher and learner roles in implementing the scaffolding strategies. The survey showed that the students had a "good theoretical understanding of PBL as an overarching pedagogical approach" (So and Kim, 2009:9) but struggled to apply it in designing a content specific lesson. Knowing one method of teaching in the absence of the rest of the teaching repertoire to draw from when needed is not enough either. ICTs in this case failed because PCK was not well established. One of the students' challenges recorded, were a lack of experience in using ICTs was a challenge. Although they had ideas, "putting them into IT" was the challenge (So and Kim, 2009:11). There was tension "between ICT tools and pedagogical use". Even those with ICT skills had problems with "selecting tools and resources appropriate for their target groups of learners and designing learning activities" (So and Kim, 2009:11). One student expressed, "With the myriad of resources available, it was hard for me to select the appropriate one for the pupils to use and learn". Having too many resources adds to the already existing complication that a novice has of getting to a point where they appreciate the amalgamation of pedagogy and content, more so that pedagogy incorporates knowledge of many other aspects that influence the effectiveness of a lesson presentation.

The adoption of ICTS should be a result of the realisation of its benefit to a particular aspect of one's teaching, otherwise if not, it becomes a burden and an unpleasant experience that many would shun. The other student pointed out, "The problem of marking the package, ICT based, which cannot be otherwise substituted with non-ICT tools" (So and Kim, 2009: 11) was another problem. This problem seems to stem from making the tool a priority at the expense of it being engaged for its value in the specific activity. That motivation is critical in engaging these digital tools for educational purposes. The tool should be used when needed, to enhance pedagogy and delivery of content. It might be worth it to put more emphasis on PCK where detail about classroom conversation is disclosed and the use of the tool is meant to enrich this knowledge domain. Learners can learn without ICTs, and yet ICTs can be used as powerful tools to facilitate learning. Perhaps what needs to be established is what it is that needs to be enhanced in a classroom. It cannot only be the development of cognitive skills, but everything that helps achieve our educational outcomes. The integration process ought to be viewed from many angles of pedagogical value if teachers are to accept that ICTs support learning.

Although the students in the above study agreed that ICT integration had benefits, they reported that it takes a lot of time and requires IT skills from both teachers and learners. Contrary to this view, the programmer teacher participating in this research claims his use of ICTs saves time and it does not take him long to prepare for his lessons. The reason could be that he has technology skills he needs to achieve his teaching goals. Much as the ICTs are enhancing his teaching, the other teaching methods through conversation are at play and occupying a significant role in the process.

Conclusion

Based on the literature review above, there are a number of factors that appear to inform the relationship between espoused and enacted practices. These mainly relate to both external and internal factors that ultimately determine the formation of teacher beliefs and respectively determine the extent to which teachers integrate ICTs in their actual teaching practice.

What is of value in the South African Education Context?

The key phrase that was used in the selection of the seven South African teachers in this study which was, "ICTs add value to my teaching" will now be addressed in context of the national education curriculum. Durkheim (1956: 120) emphasises that, "Each type of people has its own education which is appropriate to it and which can serve to define it", which is foregrounded in the dictates of its moral and political ideals. It is this country's obligation through its education system to prepare its citizens for engagements that will help meet its societal and economic needs locally and globally. According to Durkheim (1956:120), these imperatives are not static, but change depending on the "social conditions on which human needs depend", compelling the education sector to go through phases of transformation as it modifies its constructs to match the desired outcomes.

After twenty years of democratic rule, the South African education system has undergone three developmental changes in its curriculum that were instigated by its struggle to tailor its endeavours to meet, particularly the issue of redressing equity and quality. Different types of resources have been injected by the government and the private sector to try and support schools, particularly those who continue to underperform despite the drastic curriculum changes. These have suffered most in the transformation process as the agents of change (teachers) have struggled to adopt and adapt to the innovations.

Although the South African education system has the mandate to prepare all learners for active participation in its society, teachers are the instruments through which this obligation can be met

regardless the circumstances they work from. In the context of this study, teachers are mediators of knowledge and their purpose for teaching "is to make student learning possible" (Laurillard, 2002:11). In the event of ICTs adding value to teaching, it follows then that learning benefits from the experience. Before directly engaging with the quest for this study, which is to:

Establish principles that can contribute to the development of a generic framework for ICT teacher training that would cater for any learning environment; in order to understand what, from the education policies and academic discourse could teachers mean by declaring that ICTs add value to their teaching.

Laurillard (2002) has been influenced by these principles in her development of the Conversational Framework to try and demonstrate how the teacher teaches in this type of approach through teacher-learner interaction. She emphasises the fact that, the teacher should have an understanding of how learning takes place. As has already been mentioned, the South African education curriculum goals appear to be aligned to constructivists' principles. The evaluation of what this study considers to be the two main policies in the context of ICT in education seeks to identify what is of pedagogical value in the use of ICTs in South African educational institutions.

National Curriculum goals

Curriculum goals are derived from studies of society, learners and subject specialist (Lunenburg, 2011) and they reflect the country's values and aspirations. The South African National Curriculum Statement (NCS), the Curriculum and Assessment Policy Statement (CAPS) (DBE, 2011:4) goals indicate what espoused and enacted teacher practices should reflect if they are to be relevant in their practice. Use of ICTs that promotes the achievement of any of these general aims would then deem the gadgets of value to teaching and learning.

In the review of the goals, this study will try and demonstrate how policy suggests the active participation of the learner and how teachers through their use of ICTs in their rhetoric can make that possible. The first goal states:

> a) To ensure that children acquire and apply knowledge and skills in ways that are meaningful to their own lives. In this regard, the curriculum promotes knowledge in local contexts, while being sensitive to global imperatives.

This goal positions the learning process at the discursive phase where the teacher and the learner interact to attain desired topic descriptions. Narrative media forms can then be used to present

content in different forms to help establish the content structure. The use of multimodal texts and multimedia can help to augment the teacher's rhetoric and to alleviate the assimilation of new knowledge. Analogies and examples that are used in the conversations to help learners make sense of out of context concepts and symbols can begin with local and experienced knowledge. Concepts become meaningful or relevant to learners' lives if the teacher as the mediator locates his descriptions in familiar contexts and later extends application to different scenarios to promote knowledge transfer. In the process of acquiring and applying knowledge, classrooms do not have the capacity to display both local and global settings and for that reason engagement of different symbols and media that can be easily accessed in the use of ICTs would help teachers expose these to learners in the learning process.

b) To equip learners, irrespective of their socio-economic background, race, gender, physical ability or intellectual ability, with the knowledge, skills and values necessary for self-fulfilment, and meaningful participation in society as citizens of a free country.

This goal promotes equity in the learning process to facilitate productivity. South African classrooms are populated with learners from diverse backgrounds, making it challenging for teachers to create learning environments that can cater for all learning needs. The engagement of a dialogue between learners and the teacher helps create an environment where both can use feedback to adapt descriptions internally and externally as development of learning takes place. The teacher as the facilitator of this experience can draw from his or her repertoire of teaching methods and resources to make descriptions concrete so all learners can benefit. Adaptive media forms can be used to achieve this purpose and to achieve self-fulfilment. Productive forms can be used as learners articulate their understandings of the descriptions of the world.

c) To adhere to the following principles:
   a. Active and critical learning: encouraging an active and critical approach to learning, rather than rote and uncritical learning of given truths
   b. Credibility, quality and efficiency: providing an education that is comparable in quality, breadth and depth to those of other countries

This is a direct instruction to teachers as the mediators of knowledge. They are to adopt and implement in their teaching approach these principles. The nature of the conversation as presented in the framework is such that the teacher and the learner participate in the construction of knowledge. There is no transmission or room for rote learning as the learner is critically engaged. Powell and Kalina (2009:245) support this view by saying, "Teachers should promote dialogue of the materials so that students can critically think about what they are learning. If they think

critically, they will walk away with personal meaning that was constructed on their own". In a conventional classroom, it is through verbal communication that the critical engagement is achieved. Although literature recommends utilisation of digital cognitive tools this can be achieved as the teacher engages various teaching methods and non-digital media to challenge learners into vocalising and justifying their thoughts in the context of the concept they are learning. Communicative media forms can be used if learners own the technologies, but if not, the conversation can be used as this is a form of media that the can be utilised in the conversational framework.

The second principle relates to the product of teaching. The interaction between the learner and the teacher plays an important role in determining the level of cognitive engagement. The mediator is therefore able to give feedback that can help the learner modify her actions within the boundaries of the concept.

d) The learner envisaged is as following:
    a. Identify and solve problems and make decisions using critical and creative thinking
    b. Work effectively as individuals and with others as members of a team
    c. Organise and manage themselves and their activities responsibly and effectively
    d. Collect, analyse, organise and critically evaluate information
    e. Communicate effectively using visual, symbolic and/or language skills in various models
    f. Use science and technology effectively and critically showing responsibility towards the environment and the health of others and
    g. Demonstrate an understanding of the world as a set of related systems by recognising that problem solving contexts do not exist in isolation.

It is clear that the learner envisaged in the South African context is one that is able to operate higher order thinking skills (HOTS). The transmission of knowledge would not support the desired outcome, but it is through meaningful interaction in the construction of knowledge as the teacher develops learner cognitive thinking. According to Bruner (1986) interaction plays a big role in the development of cognition and Vygotsky (1978) emphasises the use of mediation tools in this advancement of learning. ICTs, with their various modal texts provide a wide choice of tools that teachers can incorporate as they use language to make connections as they model construction of

knowledge to learners. It should be noted, however, that teachers' pedagogical beliefs on how their subjects should be taught contribute to this kind of ICT use.

Bullet e. states that learners should communicate effectively by using different symbols. The conversation in the classroom needs to help learners interpret these, otherwise their use does not guarantee successful learning experiences.

Bullet f. assumes learners have technology in their learning environment that they can use and this does not apply to learners in this study. Teacher modelling of usage is not enough to provide learners these experiences and conversations would not help either. The implication is that learners from disadvantaged classrooms and communities are excluded from this skill and that contravenes the mission of nationalising the education system.

The achievement of bullet g. can be developed through the use of a teaching approach that supports transmission of knowledge. Learners need to develop ways of thinking that will promote creation of these links and through the interaction as purported in the conversational framework, they can achieve that as they reflect, adapt and re-describe with the guidance of the teacher. In their study on the influence of computers and internet on pedagogical practices and perceptions, Becker and Ravitz (1999:381) argue that subject matter should have "important links to real world concerns and activities". ICTs have affordances that make the links between these two worlds (everyday knowledge and school knowledge). As the teacher displays these links, the assumption is that the learner is able to do the same in her mind. The teacher's role therefore becomes critical in checking if that is taking place when feedback is received. Teachers therefore have the duty of creating learning environments where an integration of dialogues and engagement of symbols through different media make the connections visible as learners are given opportunities to transfer school knowledge to authentic tasks.

> e) Inclusivity should become a central part of the organisation, planning and teaching at each school. This can only happen if all teachers have a sound understanding of how to address barriers to learning, and how to plan for diversity.

The Conversational Framework promotes inclusivity, although it might not be easily implemented in a classroom with many learners. It might be difficult for the teacher to give attention to learners who need extended assistance in that case. The use of well-designed material that is integrated effectively into classroom conversations and other teaching resources could lessen the need for

remedial intervention. There is need however for knowledge and explicit directions on how to engage with the different needs of learners with learning barriers. The framework can then be used at whatever level they operate in.

Conclusion

A teaching approach that does not align itself with teaching styles that promote these general aims can be labelled as not developing the quality of learner envisaged and thus promote inequality while working from the same curriculum context. However, teachers who are able to achieve learning goals through the use of ICTs can be considered as compliant to the policy and integrating in a way that adds value to their teaching.

In addition, Younie (2006) proposes that there are three factors that contribute to the complexity of implementing change in the classroom. They are pedagogy (teaching style); learners (their different needs and learning styles) and technology (its diverse access, availability and affordances). Based on any goal or aspect of the curriculum, ICT value would therefore be assigned to diverse variables as long as it is recognised by the user. At the level of teachers, it therefore depends on what in their teaching is enhanced and its significance in improving learner performance.

What is of value in the ICT in Education Policy?

This study will now examine what kind of ICT use the official South African ICT in education policy considers to be of value. The purpose of the ICT in Education policy is to try and promote the effective use of digital technology in South African educational institutions. The policy is subordinate to the National Curriculum Statement and is meant to give guidance to the ideal implementation of ICT pedagogical integration that promotes the achievement of the curriculum goals.

To begin with, it is important to appreciate the premise from which the policy operates from, which is the acknowledgement that "ICT has improved the quality of education and training" and that "The ICT revolution has had an impact on curriculum development and delivery and continues to pose new challenges for education and training systems around the world" (Department of Education, 2004:6). Ramsden (1992) refutes this assumption by stating that these gadgets have failed to live up to their promises. A number of authors in South Africa and internationally have argued that the benefits of ICTs are not a given. In his support of this view, Ramsden (1992) argues that teaching is a form of conversation which should be driven by well-structured goals, dialogue

and activity. These contradicting factors vary in terms of effectiveness in the learning process, based on the extent to which pedagogical issues are addressed.

The policy seems to acknowledge the difficulties that are lightly to hinder its implementation in its presentation of the following challenges: participation in the information society; how ICT impacts on access, cost effectiveness and quality of education; and the way ICT is integrated into the learning and teaching process. Issues of access, cost effectiveness and participation in the information society will not be the focus of this study but will be used to support assertions where necessary to support claims that help define the extent to which e-education is implemented in the classrooms.

e-Education defined

The concept of e-education refers to the "use of ICTs to accelerate the achievement of national education goals" (Department of Education, 2004:15). If educational objectives are met, performance in terms of quality becomes an inevitable consequence. The use of ICTs in such a case is of value to the teaching and learning process. In his argument with Clark (1983), Kozma (1994) agrees with this claim by proposing that technology affordances be used to influence particular student learning circumstance. It has been established that the national curriculum goals envisions a learner that is able to participate in her construction of knowledge. ICT use therefore that does not promote this aspect in the learning process would not be of value. However, the attainment of educational goals is a broad outcome, especially when teaching approaches are understood and at times controlled by different circumstances.

The ICT in education policy envisions an e-Education that provides communication and access for teachers and learners to "better information, ideas and one another via effective combinations of pedagogy and technology" (Department of Education, 2004:15). Although this assertion seems to acknowledge the integration of pedagogy and technology, the provisioning of communication is at a technical level as they interact with one another. However, as it seems to be Laurillard's view, media does not only refer to ICTs and for that reason, this communication can be happening through any media. In the case of this study's context, the presence of ICTs as digital media provokes the interaction that takes place in some of the classrooms. Learners do however benefit from the pedagogical 'ensemble' that is mediated through conversation and is believed to be enriched by the use of ICTs.

Section 2.3 in this policy makes explicit what the pedagogical imperatives are in the usage of ICTs in the classroom if they will be of value in the context of meeting educational objectives. It

(Department of Education, 2004:15) states that e-Education should not be about developing computer operational skills, but empower the learner with the following abilities:

a) apply ICT skills to access, analyse, evaluate, integrate, present and communicate information;

The implication here is that the teacher and the learner utilise ICTs to manipulate information in the transfer of knowledge in order to broaden contexts where it can be applied. Although the Conversational Framework does not distinctly demonstrate this problem solving cycle, the interaction leads to the accomplishment of the same outcome. Laurillard's (2002) media forms for instance end with the learner articulating her product with any media. In the case of learners who do not have access to digital technology, a different (non-digital) media could be used instead. Oppenheimer (1997) stresses that computers should not be used for mere collection of information but for helping learners think about it and better still, generate new forms of knowledge (Wilson-Strydom and Thomson, 2005). Bransford, Brown, and Cocking (2000) also warn that the benefits of technology use is not a given, but that it mainly depends on how the teacher uses them in his classroom.

b) Create knowledge and new information by adapting, applying, designing, inventing and authoring information;

Learners in this study do not have an opportunity to create knowledge through the use of ICTs as they do not have access to them. However as already been mentioned above, the teacher, through classroom conversation enriched by digital technology is able to guide them into having the same experiences while using other technologies. Pachler in Leask (2003:25) supports this view by arguing that learners should be trained on how to think in "problem solving skills and not on computer skills per se". Problem solving requires these skills and as authentic problems are presented and solved, new knowledge and ways of operating in life are generated by ICT users. Learners should then be more flexible and able to transfer knowledge forms to different contexts. The Conversational Framework facilitates this level of learner operation as the teacher ensures learners share the same description as that of his or hers so they can efficiently transfer their knowledge and skills to real world problems. ICTs come with affordances that give access to different contexts, making the development of skills needed for transfer more feasible and efficient.

c) Enhance teaching and learning through communication and collaboration by using ICT;

In the context of this study, communication and collaboration is at the level of concept development and the teacher and learner work together in this process. Therefore, enhancement is not through use

of ICTs as the vehicle of communication and collaboration, but it is in the nature of its infusion into the process.

In a case where enhancement of the above process as stated in the policy relates to the use of ICTs as the medium for the transaction, expertise in guiding the engagement would be necessary as these interactions are bound to deteriorate to mundane communications that do not add value to the achievement of educational objectives. There is social networking principles based on educational theories that the user would have to follow if the communication will be fruitful, to the benefit of learning or teaching.

d) Function in a knowledge society by using appropriate technology and mastering communication and collaboration skills.

This operation is at an advanced stage of ICT usage and can be realized by the user using and being exposed to technology over time. Learners who are only exposed to predominantly conversations enriched by the technology at teacher level would be excluded from acquiring these skills that are critical in reputable job requirements or at applying strategic computer skills to enable them to operate meaningfully in the knowledge society. Modelling good and effective use of technology by teachers in the learning experience would not empower learners to be proficient participants in this contemporary society until they hold these gadgets in their hands.

Although the design of the policy is informed by research, considering that the South African society is culturally and economically diverse, some of its assertions do not accommodate learners or teachers from communities with fewer resources that need extra foundations to help them make the first step towards implementing its imperatives. It is unimaginable to expect teachers with limited digital resources in their conventional teaching that already poses challenges with learner special needs? It would help for instance to acknowledge that technology cannot, on its own perform this role but the integration of different teaching strategies, any teaching resource, all woven together by the goal-oriented dialogue between the teacher and learners.

Secondly, the policy does not indicate the significance of the teacher and his teaching approach for instance, but seems to imply that the change is spontaneous and is caused by the “usage” of computers – whatever that means in the context of the classroom.

This omission leaves the teacher at sea where knowing what processes he should engage in to produce learner envisaged is concerned, particularly in most South African classrooms where there

is at least one digital technology that is mainly available for the teacher's use. The unsuitability of the Conversational Framework is commended for its ability to show the importance of the role of the teacher as he or she facilitates learning through classroom conversation. It brings in ICTs as tools for enhancing what is already there – a conversational frame. This aspect is not made explicit in this policy.

In its attempt to probably demystify the ambiguity caused by misconceptions in the use of ICTs in schools, the policy explains that, 1) "teaching and learning **about** ICT (exploring what can be done with ICT), 2) learning **with** ICT (using ICT to supplement normal processes or resources), and 3) learning **through** the use of ICT (using ICT to support new ways of teaching and learning)" (DoE, 2004:22). An understanding of these assumptions is needed if teachers are to implement ICT integration as the policy advocates, and yet this study finds the interpretation of the three instrumental adverbs (in bold) debatable and problematic.

In the case of this study, teachers have an understanding about what skills are needed to operate ICTs at their disposal, hence their independence to use them without technical support and they should have explored 'what can be done' with ICT at the level at which they are currently operating. However the extent to which they utilise the technologies is relative as is indicated later in Chapter 5 and 7 of this study. Nevertheless, an exploration of what can be done with ICTs can be a life experience as long as one continues to update them as technologies advance and needs for their use change in the classroom.

According to this document, teachers who teach with ICTs use them to augment or 'supplement' their 'normal' teaching. This could imply that they are used to enrich teaching or in Laurillard's (2002: 89) terms, "support the Conversational Framework and thereby assist the learning process". On the other hand, the consequences for its use might not be what is expected because what might be described as normal teaching might not allow usage that leads to an enhanced teaching and learning experience, thereby fail to provide the pedagogical value that should come with the use of ICTs.

This study finds the meaning assigned to the idea of learning through ICTs problematic, particularly the notion that it is associated with supporting 'new ways of teaching and learning'. While this study accepts that the presence of ICTs promotes new ways of teaching, it is not so clear how different that is in the context of teaching 'with' ICTs. If teaching with ICTs denotes using them to augment classroom conversation that is, teaching, does it not follow that engagement of the new technologies then would bring new ways of teaching and learning? As already been indicated in this

literature, the use of computers changes the classroom conversation (Burbules and Bruce, 2001). The change referred to here as in Laurillard (2002) is not related to affording thinking abilities that would not have existed in the normal teaching that is supposed to be 'supported' as the policy seems to imply. It gives the impression that as teachers advance in their use of ICTs, they adopt or develop new ways of teaching where the user "fully realises the potential of ICT" (DoE, 2004:22) and as a result they engage "high quality, relevant and diverse resources" (DoE, 2004:23) which then leads to,

> understanding requiring the use of higher-order thinking skills, and taking learners beyond recall, recognition and reproduction information to evaluation, analysis, synthesis and production of arguments, ideas and performance.
> (DoE, 2004:23).

The implication from this extract is that new ways of teaching are enabled by the affordances of ICTs. If that is so, this account is misleading especially if the role of the teacher in enabling the ICT to make expected impact on the teaching is not acknowledged. Whereas this study agrees with the value that ICTs can bring, this can be interpreted as meaning that technology is the agent to the transformation of teaching and learning, the development of thinking skills or the achievement of performance thereof. Credit needs to be given to what Dron (2012) describes as the "elephant in the room", the teacher, who actually instigates the impact that ICTs bring to the learning experience. Laurillard (2012:5) recommends the following procedure that should set the priorities in our guiding principles on the conceptualisation and process of the integration of ICTs.

> We have to articulate what it means to teach well, what the principles of designing good teaching are, and how these will enable learners to learn. Until then, we risk continuing to be technology-led.

It is therefore imperative that while this policy promotes the use of ICT affordances, it makes clear the role they can play in the context of the actual teaching or the conversation that already exists to avoid a case like that of one of the participants in this study whose enacted practice displays little evidence of learning taking place from the immediacy of technology as the 'normal' teaching is withdrawn from the scene as the technology assumes his position.

Teachers teach with ICTs at any integration level for that matter and their teaching is transformed in the sense that infusion of a technology automatically alters the teacher's conversation as the usage either alleviates or deteriorates the quality of the lesson delivery. This study contends that it is the quality of usage by the user - the teacher that advances the performance and not the technology.

Dron (2012:26) extends this view by arguing against giving credit to technology by saying, "to treat any part of the educational machine as though it were an independent of the whole is as odd as suggesting that a spark plug is not a car engine technology because it does not in itself involve driving". As long as the capability of the real agents of this change, together with their ingenuity in controlling the complexity of everything else that makes it possible to learn is not given the attention they should get, the gap between ICT policy and its implementation will continue to grow as educational institutions continue to accumulate more and more advanced technologies.

In the case of this study, what seems to be happening though is that teachers are teaching with ICTs (as teaching tools) and learners learn 'through' ICTs, meaning that they get understanding through the use of ICTs by their teachers. Crook (1994) describes learning through ICTs as learners using digital technologies to learn, in other words, receiving their tuition through their use of the technologies. The ICTs are the medium of learning in that case. Learners can learn through a radio, a television, reading a book as media of learning. The voice or speech is a medium of learning and other media can be used to support it. Learners then are learning through speech enhanced by the other media. All media involved are contributing to the occurrence of learning. The question now is, cannot learners learn through their teacher's use of ICTs - the teacher using speech as a medium and ICTs supporting it or him? Both these media are used as mediation tools. In other words, they are used as instruments that contribute to making learning possible. The argument that this study is trying to make here is that, learning through ICTs need not be limited to learners having direct contact with ICTs, but contact can be achieved still through other senses which in this case are visual and audio. It is for that reason that this study uses the lens of the Conversational Framework to accentuate the significance of the teacher in making use of ICTs as supplementary media so learners can learn through these digital technologies.

While Laurillard's (2002) approach to teaching also advocates for learner-centeredness as the learner is actively involved in the learning process (learning activity), the Conversational Framework demonstrates how important it is to make explicit this learner activeness as evidence that ICT use is making a difference in the activity. Without that evidence through the interaction in the classroom, learning benefit through ICTs remains a myth that contributes to the misinterpretation and poor implementation of the policy.

The teacher's learning goal and the way the conversation is guided determines what skills will be developed with or without digital technology. Digital technology has its role in supplementing

teaching but it is the teacher that regulates it as the dialogue progresses in the learning activity. Its pedagogical value therefore depends on the extent to which it augments the conversation.

Whereas subject policies generally advocate for multimodality that can be used to enrich high levels of thinking as they manipulate the productive forms in the construction of knowledge, this policy explicates, in a way, how that can be done. For instance in bullet 3.7 it says,

> Our quest for active contextual learning to promote understanding will be supplemented by multi-media applications that require learners to create realistic context for problem-solving, data analysis and the creation of knowledge in the learning process.

Although the approach suggested above is undisputable, its applicability in the context of this study is different as learners do not have access to learn through the activities and yet they are able to benefit from the teachers' integration of multimedia into the conversations. The infusion helps learners make sense of and make connections through the different media and modal texts used in the delivery of the lessons.

Conclusion

Although the ICT in Education policy, the White Paper on e-Education, advocates for the value of digital technology in 'accelerating the achievement of educational goals', it fails to make vivid or give the significance of the role of the teacher in the use or presence of ICTs. The Conversational Framework and the media forms seem to serve the purpose of opening spaces for the teacher to identify which ICTs can be used to enrich which pedagogical aspect, which is in fact a conversational process. The problem is that the policy puts emphasis on the benefits from the tool as if the tool on its own is able to transform the teaching and learning in the classroom. However, a closer look at this policy facilitated a rather profound and yet objective understanding of how ICTs can be effectively used to achieve the CAPS general aims for teaching and learning. This discussion in a way is already giving indicators of what ICT usage qualifies (according to the two documents) as valuable and not necessarily of value in poorly resourced classrooms. While it is acceptable that policies give guidelines on what teachers should pay attention to, it is disturbing that there are elements in both policies that seem to exclude learners learning in environments that do not have digital resources. However what is emerging from them is the adoption of a learner-centred teaching approach recommended does not necessarily demand direct access to ICTs especially in the CAPS

document. The main usage of ICTs use that is of value should be that which accelerates the achievement of national curriculum goals.

Conclusion

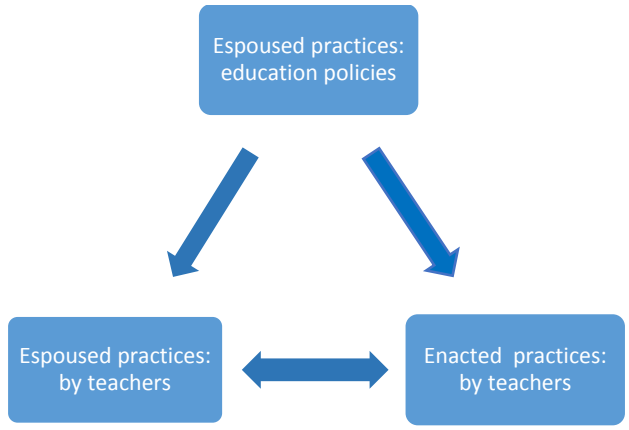
In the description of what ICT pedagogical integration entails, this literature review covered issues that contribute to making explicit what is of pedagogical value in the use of ICTs by teachers in schools. The Conversational Framework seems to drive the advocacy of the teacher's role in the effectiveness of ICT use in the classroom. If the teacher's role through engagement of the conversation which incorporates non-digital resources and all that participates in the learning activity is absent, ICTs are likely to be ineffective in enhancing teaching and learning. Pedagogical value is therefore determined by the teacher's ingenious involvement in manipulating each pedagogical feature to help learners learn. It is also clear that what teachers eventually do in the classroom can be a product of many factors that influence formation of beliefs about the use of ICTs. It is these beliefs that tend to have a stronger influence on the teacher's enacted practice. However, it is also evident from the studies captured in this literature review that teacher beliefs are not always consistent with the actual teaching as experience in applying them is crucial above what their theoretical groundings about ICT value are. The South African Education policies make clear what is of pedagogical value, but the ICT in Education policy in particular does not seem to be be generic enough to cater for classrooms with fewer resources.

Chapter 3

Research Design and Methods

Introduction

This chapter gives an account of the methods and research design used in this study to facilitate a valid response to its main research question which is: *What is of ICT pedagogical value in the classroom practices of seven South African secondary school teachers?* As indicated in Chapter 1, the triad below illustrates the data sources that will be analysed in isolation and later related to each other to enable a response to the research question.



In its attempt to make explicit what is of value in the ICT pedagogical integration of the seven South African township secondary school teachers, this study adopts Laurillard's Conversational Framework. Methodologically, the framework reveals how the construction of knowledge as proposed by Vygotsky and Piaget takes place through teacher-learner interaction.

Research Design: Multi-case Study

The choice of a research design for this study was made based on some considerations that would help respond to its quest for the description of the phenomenon under study. It sought a design which would reveal a "set of interpretive material practices that make the world visible" (Denzin and Lincoln, 2013:6). The visibility of how ICTs add value to teaching and learning is significant in this study. It is for that reason that a qualitative design is employed as it studies "things in their natural settings, attempting to make sense of, or to interpret, phenomenon in terms of the meanings people bring to them" (Denzin and Lincoln, 2000:3). This type of research goes further and

"describes and analyses people's individual and collective social actions, beliefs, thoughts, and perceptions" (McMillan and Schumacher, 2006:315), which is what this study does in its investigation of teacher practices.

Seven teachers are involved in this study and for that reason this thesis adopts a multi-case study. This is because the use of ICTs by each subject teacher is a case on its own and contributes to the formation of "a collective understanding" of the phenomenon, which is the ICT pedagogical value in classroom conversation (Stake, 1995:4). Such a study can include "a number of sites or participants for the study", (McMillan and Schumacher, 2006:316). In this case six schools and seven teachers have been selected for acknowledging that their ICT use for teaching and learning has value. This type of study (multi-case) is recommended by Miles and Huberman (1994) for its potential to develop a generic theory, which is the intention of this study.

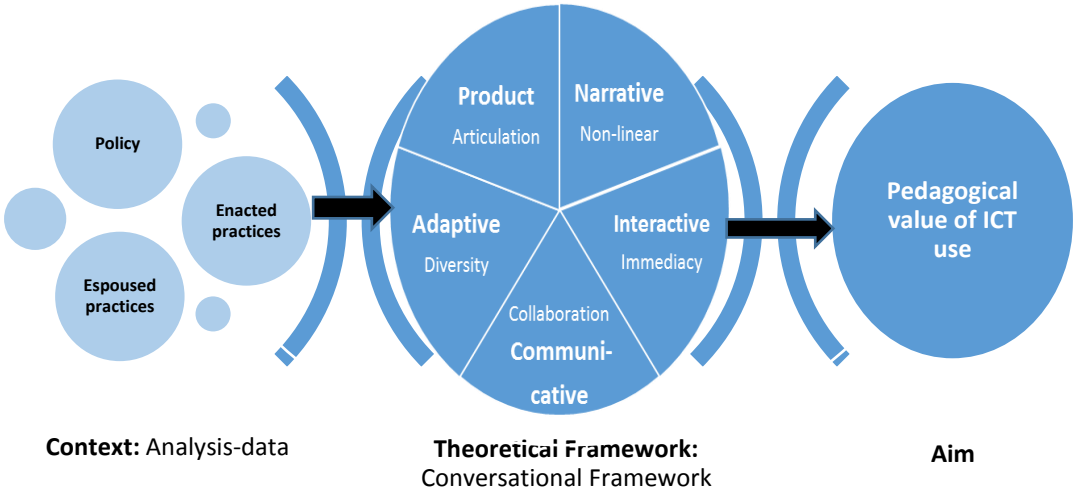
Simons (2009:18) defines a case study as "that process of conducting systemic, critical inquiry into a phenomenon of choice and generating understanding to contribute to cumulative public knowledge of the topic". Yin (1994) believes that such a study should be carried out within the natural or real-life context. This research adopts this methodology as it analyses education policies, espoused and enacted classroom practices of teachers under study to identify what is of pedagogical value in their use of ICTs. It is hoped that the findings do not only become public knowledge, but help develop an ICT teacher training programme that is relevant to this country's classroom needs. Teachers are likely to integrate if they believe ICTs have the potential to enhance teaching and learning (Chikasha, Ntuli, Sundarjee and Chikasha, 2014).

Sampling

According to Stake (2000), the selection of the sample is critical in a case study. If not formalised, the phenomenon to be investigated might not be found in the sample and the results of the study could be futile in the sense that the research questions would not be responded to. As this is a multi-case study, the type of sampling is unique because "each setting has a few properties it shares with many others, some properties it shares with some others, and some properties it shares with no others" making its findings robust (Miles and Huberman, 1994:29). What is common among teachers in this study is that they all use ICTs to teach, but how they use them is different. The use of the analytic tool developed from Laurillard's (2002) and Conole and Dyke's (2004) concepts manifest these similarities and differences in teacher practices.

Generally in a qualitative case study, "we draw *a purposive sample*, building in variety and acknowledging opportunities for intensive study" (Stake, 2000:446). Purposive sampling is used for the purposes of identifying cases where the most could be gained on the phenomenon to be studied (Merriam, 2009). Based on this study's conceptual framework below, ICT pedagogical value is the phenomenon to be investigated and the sample selection had to use that as its key for the adopted criteria.

Figure 3.1: Expanded Conceptual Framework



According to Miles and Huberman, 1994, in a multi-case study, the selection criteria are usually determined by the conceptual framework. In relation to this study's frame, schools selected had to be those with teachers who believe their ICT use has pedagogical value. The analytical framework as already mentioned helped describe teacher practices and the accountability of education policies to give guidance to teachers in their integration of ICTs into teaching and learning.

Selection of sites

The schools as sites were identified first. Miles and Huberman (1994) recommend that a case study selection should, "Set boundaries: define aspects of your case(s) that you can study within limits of your time and means, that connect directly to your research questions, and that probably will include examples of what you want to study" (1994:27). As stated in Chapter 1, this study is a

response to the PanAf (2009-2012) research that revealed that despite ICTs having a potential to enhance learning, ICT integration levels of a representative of teachers in Gauteng secondary township schools was low regardless availability of these digital resources and teacher ICT training offered to prepare them for usage. The criteria for the *sites* therefore demanded that secondary schools to be selected be located in townships and that its teachers teach their subjects with ICTs.

In order to reduce the sample to a manageable size, decisions related to contextual issues were used as a guide. In the case of this study, Sondlo and Subotzky (2010) confirm that the majority of school leavers are not ready for tertiary education. In order to be relevant to challenges the South African education faces, Grade 10 to 12 teachers in the Further Education and Training (FET) phase were included in the selection criteria, making the sample politically important (Miles and Huberman, 1994). The selected grades are in the phase where learners are prepared for higher learning. To facilitate an in depth investigation of this case study (Marshall and Rossman (2011), the sample size was reduced further by demanding that participating teachers be teaching the core Matriculation subjects (Language, Mathematics, Life Orientation, Social Sciences and Natural Sciences) as these are usually considered as basic entry requirements for local colleges and universities. In addition, selected teachers had to attest to teaching with ICTs frequently in a way that brings value to teaching and learning.

This study is a follow-up on the PanAf research that was carried out in the Gauteng province and a district in the same province was selected. A stratified purposeful sampling was executed in the selection of the district (Punch, 2009; Marshall and Rossman, 2011). The district had a representation of township school population with teachers using computers to teach. Although there are many such districts in the province, convenience sampling was implemented in this case because of the district's easy access (Scott and Morrison, 2005).

The next step was to identify schools in the selected district with FET teachers who use ICTs to teach their subjects. With the help of an informant from the district's e-learning department provided a higher chance of finding desired participants (Marshall, 1996). The researcher was able to acquire names and telephone numbers of all secondary schools with the aim of identifying FET teachers who claim their use of ICTs bring value to the teaching and learning in their classrooms. Out of 34 schools with teachers supposedly using ICTs to teach, 19 met the basic criteria of being located in the townships and were convenient to accessible (Scott and Morrison, (2005). Through telephone calls and school visits in some cases, the researcher was able to identify only seven teachers in six schools who met the criteria. The schools have been described in Chapter 1 in this

thesis. The rest of the schools either had teachers who used computers to teach lower grades (Grades 8 and 9) or had left the school for different reasons.

Selection of participants

The selection of participants was not driven by representation, but by a conceptual question or ground (Stake, 2000; Miles and Huberman, 1994). In the case of this study, the participants were chosen based on their claim that their use of ICTs for teaching has pedagogical value. The teachers had to be using the technology frequently as it is from such behaviour that the phenomenon under study could be manifested intensely (Scott and Morrison, 2005). In addition, teachers had to be teaching core subjects in the Further Education and Training (FET) Phase (Grade 10 to 12) as already mentioned. To protect their anonymity, pseudonyms have been used and the schools they teach on are referred to as School A to Fin this thesis. There are four Matriculation core subjects that are taught by these teachers and their teaching environments will be described later. Although the initial plan was to include the full set of the core Matriculation curriculum, this was not possible because a Life Orientation teacher who met the criteria could not be identified from the initial19 schools in the selected district.

The teachers identified were all male, except Bambisana. Gender balance in the selection of the teachers would have been ideal, but such diversity was thrown up by the sampling criteria. In other words, the phenomenon investigated determined the selection. Detailed participant profiles are provided in Chapter 5. Patton in Marshall et al (2013:12) discloses that there are no rules in the sample size in qualitative research design and that it depends on "the purpose of the inquiry, what's at stake, what is useful, what will have credibility, and what can be done with available time and resources". Maykut and Morehouse (2003:56) accentuate that the "approach for selection depends on which will give the clearest understanding of the phenomena". The sample size in this study was therefore based on the resolution controlled by the criterion used and was more likely to provide the study with adequate information about the topic of interest.

This study intends using its findings from different subject contexts to develop an ICT teacher training programme that can benefit teachers teaching any subject in the Further Education and Training phase. In their support of a similar multi-case study methodology, Miles and Huberman (1994:29) claim,

> By looking at a range of similar and contrasting cases, we can understand a single-case finding, grounding it by specifying how and where and, if possible, why it carries on as

> it does…If a finding holds in one setting and, given its profile, also holds in a comparable setting but does not in a contrasting case, the finding is more robust.

Merriam (1998) alludes to this notion by stating that a case study can accommodate a range of disciplinary perspectives. Each case is given its own description that is distinct to the rest. Stake (2006:vi) contends that although the cases might be different, the main interest in them is in the "phenomenon exhibited in those cases". He adds that while the cases might be different, "each case study is a concentrated inquiry into a single case" which in the case of this study is the ICT pedagogical value teachers in township secondary schools portray in their practices. McMillan and Schumacher (2006) suggest that participants in a case study might perform the same activity but experience it differently. Teachers in this study all use ICTs frequently, and yet they do so differently. It is the uniqueness of each case and how it contributes to the understanding of the same phenomenon that adds richness to this study. Hopson (2001-2002) supports this view by describing computers as tools and emphasizes that they are independent of 'subject' matter. That can be interpreted to mean, how they are used does not necessarily relate to the type of subject and yet the way they are used would relate and be specific to the enhancement of the subject concept. This view relates to Laurillard's (2002) belief that the Conversational Framework and the media forms that contribute to the phenomenon under study can be applied in any subject.

Description of sites and participants

While a detailed description of the schools has been provided in Chapter 1, this section will highlight how teachers relate to the schools they work from in terms of their utilisation of available digital resources. The table below outlines the descriptions of teachers selected for this study.

Table 3.1: Teacher profile

Case/ Teachers with their Pseudonyms	Subject taught	School	Hardware used for teaching	Software/ media and source of teaching materials	Display platform
1. Mshini	Physical Science	A	Laptop & projector	MS Word document (designed by the teacher)	White cloth on wall
2. Sizakele	English FAL	A	Laptop & projector	Slides (designed by the teacher)	Noticeboard painted white
3. Takalani	Geography	B	ibox	Slides (designed by the teacher)	Installed whiteboard
4. Mpetha	Mathematics	C	ibox	Slides (developed by the ibox sponsor and adapted by teacher)	Installed whiteboard
5. Mlingani	Mathematics	D	Laptop, CD & projector	Video (Department of Education)	Mobile screen
6. Moruti	Geography	E	Laptop and projector	Slides (Department of Education)	Installed whiteboard
7. Bambisana	Geography	F	Laptop & projector	Slides (Department of Education and teacher collection) + MS Word (teacher)	Installed whiteboard

The first school is referred to in this study as School A. It has a computer laboratory with twenty five computers and there is internet connectivity. The two teachers in this school do not use school gadgets but their own which consist of a laptop and a data projector to present their content on slides. The Physical Science teacher whose pseudonym is Mshini teaches from his computer laboratory and uses a section of the chalkboard to project the digital content. The second teacher, Sizakele who teaches English First Additional Language (FAL) carries his laptop around as he moves from class to class as prescribed by the school timetable venue allocation. He projects his slides at the back of the classroom on a section of the notice board.

The second school is School B and it has a big computer laboratory with twenty five computers occupying one side of the laboratory. The computers are all connected to the internet. The geography teacher (Takalani) uses the other half of the laboratory to teach his lessons. The space has a screen installed on this back side of the laboratory and learners sit facing the screen on which the slides are projected. The teacher uses an ibox, sponsored by a company that has trained him on basic computer skills that he uses to present his lessons. He develops his own teaching materials because the sponsor has not yet uploaded material for his subject.

School C is the third school. It is the only technical secondary school in this study and it has a computer laboratory with twenty five computers. The school has access to Wi-Fi and teachers and learners can connect to it while they are within the school premises. The teacher, Mpetha teaches mathematics in his classroom and he uses an ibox from the same company as that of School B. The

company has uploaded mathematics content for the teacher to use in his lesson presentations. This is the programmer in this study and extensively uses his skills in his teaching practice.

School D is the fourth school that has a computer laboratory that is currently not used for teaching and learning but for monitored learner research sessions. The teacher, Mlingani teaches from his classroom. He uses the school's laptop, data projector and a mobile screen to project the video he uses to teach with.

The fifth school is referred to as School E and is a comprehensive school (offering grades 10 – 12 only). It has a computer laboratory and in addition to that, the school library is used for lesson presentations too. The school has internet connectivity. The teacher, Moruti also teaches using a laptop and a data projector. The slides he uses to teach in the library are from the Department of Education.

The sixth and the last school, School F is a church school and it also has a computer. The teacher, Bambisana teaches geography too. She teaches her subject with a laptop, a data projector and an installed whiteboard in front of the classroom on which digital content is projected. Bambisana also uses the whiteboard to show learners how to represent 3 dimensional images with 2 dimensional drawings.

What is common in the six schools is that they have given access to teachers to teach their subjects with computers either in their classrooms or computer laboratories. Where there are limited resources as in School A, teachers use their digital gadgets so they can have unrestrained access to them.

Research Instruments

The relationship of what teachers said, what they did and how all that relates to the South African education policy is pertinent to this study, as already been indicated. This facilitates the development of the ICT teacher training framework that will be tailor-made for this country. Literature confirms that the two practices (espoused and enacted) can influence each other(Ertmer, 2005). The nature of the relationship contributes to the comprehensive understandings that this study seeks. In order to capture the impact of ICTs on the teachers' classroom conversations, the data was collected through carefully selected instruments.

According to Cresswell (2003), qualitative research has the following basic types of data: observations, interviews, documents and audio and visual material. All were used in this study except that audio was used to capture interviews and the visual material (video), for the observations. In addition, field notes were taken during the recordings as explained below.

Semi-structured interviews

After schools were identified, a visit to the individual teachers led to an informal interview. If their initial description indicated that they frequently used computers in the classroom and met the rest of the requirements, an appointment was set for the formal interview and later for the lesson observations.

Laurillard (2002) emphasises the importance of teachers knowing about their learners' learning so they can create learning environments that can enable learning. Semi-structured interviews were therefore conducted and teachers were able to disclose what they believed about learning with ICTs. Teachers could elaborate on what they meant in their initial claim about their ICT use bringing value to their teaching and learning.

In a semi-structured interview, a researcher initially uses an interview guide (prepared question prompts), but the researcher allows for flexibility in the way they are answered in order to draw as much data from the interviewees as possible (Merriam, 1998). To facilitate that, question prompts were divided into three (See appendix C). There were questions related to teacher perceptions on their learning environment and how it could have influenced the way they integrated ICTs. The second section sought to know what their understanding of ICT integration and its impact on the teaching and learning in their classrooms was. In the last section, the questions were about what teacher attributes in relation to their technical knowledge and skills were. Cresswell (2003) recommends that the questions be few to facilitate interviewees' views and opinions. That also creates space for the interviewer to elicit deeper meanings of the responses. While some responses were elaborate and some shallow, the researcher could ask other questions emanating from what the interviewee said for more clarity on the issue discussed. That became useful in the coding exercise and the utilisation of the analytical framework in the context of Laurillard's CF, to help understand what their beliefs about teaching are; the media forms, to determine how their use of ICTs for teaching and learning was of pedagogical value; the affordances (Conole and Dyke) to decide on which qualities of ICTs were engaged in the integration process.

Mouton (2013) provides a number of factors that might influence response bias and in this case; interviewees were given authority and confidence by making them aware that the researcher was going to learn from their practices before carrying out the interviews. As teachers took positions of being the expert in the use of ICTs, they became free to express themselves and by so doing some were able to reveal their misconceptions as is demonstrated in Chapter 5.

Kemmis and McTarggart (1988) recommend one-to-one as it has a potential of enriching data for analysis. Each teacher was interviewed individually and because of the detail and the intense engagement with responses in the coding process, responses had to be audio recorded. In the case of this research, the interviews with each teacher were audio recorded and later transcribed. Denzin and Lincoln (2013:126) suggest,

> Paper, unlike audio or visual media, is a familiar and comfortable form; it's easier and faster to scan a paper document than listen to or view an interview; words fixed on paper ensure accuracy of quotation in print; and they confer a certain intellectual authority on what could be construed as an ephemeral form.

The researcher therefore printed the transcripts and used them to code and highlight emerging themes as she analysed each teacher case.

Informal conversation interviews where questions arose from the way teachers had taught were carried out after the lesson observations to provide an in-depth understanding of the impact ICTs seemed to have in the learning process experienced or latter. Field notes were used to capture these responses and they were later used to reflect on the lesson observations.

After conducting the formal interviews, first-hand experience with teachers in their actual practice had to be solicited (Cresswell, 2003). This allowed for comparisons within each case and contributed to confirming credibility of teacher beliefs. Inconsistencies and similarities were therefore identified and justified and by so doing provided a rich description of each case.

Observations

During the lesson observations, teachers demonstrated what they actually do when they integrate ICTs into their teaching. The interpretation of the lessons enabled the researcher to develop an understanding of what ICT pedagogical integration entails in Chapter 8. This being a qualitative study, the observations were unstructured. Punch (2009:154) describes this type of observation

as a case where "the researcher does not use predetermined categories and classifications, but makes observations in a more natural open-ended way". Observations made in naturalistic settings "do not interfere with participant or activities under observation" (Angrasino and de Pèrez, 2000:674). Careful observation, in natural circumstances "will always be limited by constraints of reality – and all these constraints will never be clear in advance", Kemmis and McTarggart (1988). In this study, this was minimised by scheduling the observation with each teacher. This can be viewed as compromising the validity of the findings as teachers would then prepare to impress the researcher. This study argues that the fact that these teachers have not received training or guidance from policy on how to integrate ICTs into the teaching of their subjects (See Chapter 6), their usage of the technology is driven by their beliefs, whether misconceived or not.

In order to increase the validity of the data collected, the researcher introduced herself to the class in the beginning of every observation and requested that learners feel comfortable and free to participate as though the researcher was not there. She then expressed her interest in the new teaching and learning approach their teachers used with ICTs and that she wanted to learn from the experience. Although this seemed to work in most cases to allow the participants to be in their normal behaviour, one teacher complained that learners were quieter and motivated them to participate and this worked as they were even able to ask questions that sought links between every day and academic knowledge on the content covered (Bambisana's geography class). Teachers generally took the responsibility to make learners participate and this way they aligned their teaching to the Conversational Framework, though at different levels. The observation focus was mainly on the interaction and what teachers did as they facilitated the conversation. McMillan and Schumacher (2006) refer to this type as 'low inference' because it is the only specific behaviour that is captured without making judgements at that moment. Such an observation is "more reliable, necessary to make judgements based on the complexity and multitude of variables in a classroom for valid reasons" (McMillan and Schumacher, 2006:207) that are dealt with later in this study's data interpretation in Chapter 5 and 6.

In order to capture the complexity of integrating ICTs into teaching and learning, the lesson presentations were video recorded to facilitate collection of comprehensive data needed to give detailed descriptions of the process. These were viewed and transcribed by the researcher to make sense of the value ICT use had during actual lessons. The actions of teachers and learners were captured and the artefacts they used were also included and used in the synthesis of the data.

According to Marshall and Rossman (2011:205), it is important that the methods used to record data do not "intrude excessively on the flow of daily events" and to curb this, the researcher positioned her recording equipment away from teaching and learning activity, usually by the side where she could capture all teacher movements without obstructing learner view. She moved the video recorder from the stationary or fixed stand to follow the teacher's and the actively participating learners while she maintained her position throughout the lesson.

As the lesson activity was recorded, the researcher also took notes of aspects of the lesson she thought would be of interest in the data interpretation.

Field Notes

There was a need to interpret the interview responses and the observations in the context of the CF served to make explicit the learning activities. The research therefore took note of any ideas that were of interest and had a potential in making sense of the data. It is these ideas that enhanced the data from the observations and interviews and brought light to the events that took place (McNiff and Whitehead, 2009). In the case of observations, field notes do not only record "what is seen and heard, but also reflections on what has occurred" (McMillan and Schumacher, 2010). The initial interpretation took place during this process and at times questions were raised on the nature and reasons for the teachers' behaviour or decision making and followed up later. The particular data were useful in the researcher's final interpretation and evaluation of the observations and discussions with teachers.

Document Analysis

It is fundamental that the findings for this study relate to the South African Education context to enable the development of a customised ICT teacher training. It is for that reason that document analysis of educational policies had to be executed. Bowen (2009:1) defines document analysis as a "systematic procedure for reviewing or evaluating documents – both printed and electronic (computer-based and Internet-transmitted) material" and in the context of qualitative research, documents are "examined and interpreted in order to elicit meaning, gain understanding, and develop empirical knowledge" (Corbin & Strauss, 2008; Rapley, 2007). In the case of this study, four educational policy documents were identified and analysed. The analytical framework was used in the analysis. The results were used to determine if the teachers' understanding of ICT pedagogical value is aligned with what the documents advocated for. This evaluation also helped to detect if the policies are adequate as guidelines for how digital technology should be used in the classroom. Hodder (2000: 704) suggests that document analysis can "say many different things in

different contexts". The policies in this study are interpreted in the context of the framework explained in Chapter 4 and may be interpreted differently if a different instrument is used.

Identification of documents

In the selection of documents, Bowen (2009) emphasises the importance of identifying documents that are more relevant to the enquiry and to consider what their purpose is. Purposive sampling was therefore used in this case as well. The first document to be selected was the national South African education policy (2011), the Curriculum Assessment Policy Statement (CAPS) as it provides the general aims for the whole education system that the system hopes can help respond to its goal of achieving quality and equity. This is an updated version of the 2005 National Curriculum Statement (NCS) which had to be modified to help make its interpretation and implementation easier for teachers and all involved in the teaching profession in South Africa. It describes the quality of the learner the schooling system should aim at producing. The content serves in making decisions on the approach and resources to use in the classroom. The general aims are common and they precede the content coverage and specific aims for each subject and grade. An examination of the four subjects taught by teachers in this study has been done in order to determine if teachers' teaching practices are informed by the imperatives in their subjects. This process has also helped to identify statements that promote the pedagogical integration of ICTs.

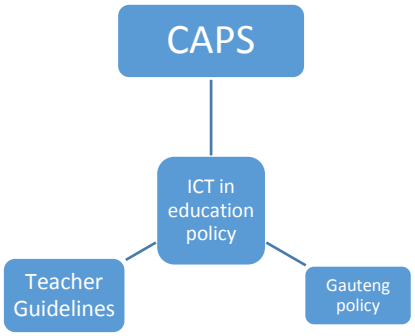
While the CAPS document should help to offer guidance at a national level on the education outcomes, the South African ICT in Education, the White Paper on e-Education (2004) is included as a policy that directly addresses the integration of ICTs into the curriculum. Although this policy was designed earlier than the national education policy, it still serves to give direction on how education institutions and the government should work together in the transformation phase where educators use ICTs to teach. Focus is mainly given to the section that provides guidance on how ICTs should be used in the classroom by both teachers and learners to achieve the national curriculum goals.

Since this study intends developing an ICT teacher training framework, it became necessary to identify a policy document that offers direction on how teachers can be prepared for the integration process. The document found was, the Guidelines for Teacher Training and Professional Development in ICT (2007). This document offers guidance on what skills and knowledge teachers need to implement the ICT in education policy above. Although the document does not necessarily provide direct instruction for teachers, it presents developmental levels that teacher trainers can use to assess teachers and provide them with relevant skills.

All teachers participating in this study teach in the Gauteng province. The last document that is analysed in this study is an ICT policy customised for the Gauteng province. It is the Guidelines on the Management and Usage of ICTs in Public Schools in Gauteng (2011). The document encompasses guidance to the management of ICTs in schools and as a result more focus is at that level and not on teaching and learning with ICTs in the classroom. However, the guidance given to teachers in the five pages of the document is what is used in this study's analysis and relates to the ICT in education policy.

The analysis of the four documents form a policy framework, that is used later to determine if the participating teachers' practices comply with them. The figure below illustrates what makes up the policy framework and how each document relates to the other.

Figure 3.2: Relationship of policy documents



In addition to these documents, where possible, other literature is used to support the interpretations. The phases followed in the analysis of the documents appear in the next sub-section.

Document analysis

Once identified, the phases that have been used to analyse the documents are as follows:

1) Description of the policy – what its value is in this study,

2) Evaluation – through the use of the analytical framework, to determine its adequacy as a guide for teachers in making explicit what ought to be of value in their ICT pedagogical integration. The analytic tool had to be adapted so that it made sense in the context of the original tool. In order to prepare for the infusion, the overview highlighted features in the policies that contribute to the formation of the policy framework. The following table is used for this phase:

Table 3.2: What is seen to be of pedagogical value

Media form:_____		→	**Policy framework overview**
Affordances-Knowledge and skills	Nonlinear		*An integrative description of the policies meant to highlight what is of pedagogical value in each media form.*
	Policy number and page: relevant extract from the policy/ies		
Content Analysis	Multimodality		
	Policy number and page: relevant extract from the policy/ies		
Pedagogical value	Content structure/ Connections		
	Policy number and page: relevant extract from the policy/ies		

3) Relationships - what is the relationship between teachers' espoused, enacted practices and the policies? In this phase, a table in Table 3.1 is used to determine the coherence and alignment of each teacher's practices to the policy framework.

Hodder (2000) argues that documents should be analysed in their social context and alongside other evidence to facilitate the understanding of the inherent biases in each of them. The CAPS document proclaims what this country values in its schooling system. The rest of the documents, in their hierarchical order as presented above tend to relate to it or each other in some way as they attempt to support the curriculum goals. The analytical framework helps to integrate the policies in the context of ICT pedagogical integration and to determine what should be of value in the teachers' practices. This infusion forms the policy framework that is later used in Chapter 6 to relate to teacher practices.

The research methods used to gather and analyse data should be related to the research hypothesis and other data sources like observation, interviews, document analysis and questionnaires (Crotty, 1998; Bowen, 2009). The same analytical tool was used for the analysis of the other two data sets as illustrated in the triad figure earlier in this chapter to address this study's research questions and the conceptual framework as proposed by Bowen (2009). This study values the context from which teachers operate and it is for that reason that the above four policy documents have been analysed through the use of this study's analytic tool.

Data Analysis

Data was analysed during the data collection process and every input contributed to a deeper interpretation and understanding of what it is that participating teachers in this study value in their pedagogical integration of ICTs. This is later matched with the policy framework for compliance.

As has already been mentioned, the field notes contributed to the initial analysis as the researcher tried to make sense of the teachers' experiences. These notes were used to follow up on interview ambiguity in teacher responses and in capturing aspects that seemed to be pertinent to the distinct description of teachers' enacted practices.

When all empirical data had been captured, the next step was coding. Sadaña in Bowen (2009: 16) describes coding as an "interpretive act meant to be the transitional process between data collection and more extensive data analysis". The conceptual framework of this study was used to develop the analytical framework that could be employed to decipher what is of pedagogical value in each teacher's integration of ICTs and the policy framework. This process continued until the reformulation covered all cases, different as they were (Robinson's cited in Merriam, 1998) and yet focused on understanding the phenomenon understudy. The analytical framework developed and explained in Chapter 4 is as follows:

Table 3.3: Analytical framework

Media forms	**Affordances** ⟶	**Evidence** ⟶	**What pedagogical value does it add?**
Narrative	Non-linear	Multimodality	Apprehending structure/ connections
Interactive	Immediacy	Immediate feedback	Exploring: misconceptions amended
Communicative	Collaboration	Discussion: class/ group	Re-descriptions of concepts
Adaptive	Diversity	Reproduction: experiment/ role play	Concretising theory: practice
Productive	Articulation	Product: animation/model	Knowledge construction

What needed to be established was what it is that was of pedagogical value in terms of Laurillard's (2002) description of the Conversational Framework. When the analytical framework was established, the next step was to identify words and or phrases in the teachers' practice transcriptions that relates to the description of ICT pedagogical value as presented in the analytic tool. The descriptive coding through the use of the analytic tool was used first. Bowen (2009:17) describes this type of coding as preliminary data analysis and it "leads primarily to a categorised inventory, tabular account, or index of the data's content". Descriptions based on the content on the analytic tool (ICT affordances, evidence and the pedagogical value) were used to summarise and latter populate tables where all teacher practices and policy framework considerations were captured. This is inductive inference. Mouton (2012:81) states, qualitative research can now "use a form of inductive inference called analytic induction, to generalise from a small number of examined cases to a larger population of similar cases". Robinson cited in Merriam (1998) claims the analytic induction influences the steps taken to analyse the data.

Once summaries had been made on descriptions of all the data, coding based on the relationship consistencies and inconsistencies ensued. Sadaña in Bowen (2009:17) commends this type of coding for its ability to "make judgements about the program… and to inform decisions about future programming". In the case of this study, this step helped make judgements on the type of teacher ICT usage based on what they seemed to value in their use of ICTs and could therefore be matched with the policy framework. This exercise was also performed to determine the policy framework's accountability as a guide for teachers in the integration of ICTs that has pedagogical value. The table below illustrates how teacher practices were presented and related to the policies, based on the analysis presented in Table 3.2.

Table 3.4: Triad relationships

Media Form	Espoused	Enacted	Policy: Practice aligned
Narrative	Key use of ICTs for teaching with the narrative media form	Key use of ICTs for teaching with the narrative media form	Aligned or not aligned for each teacher practice
Interactive	Key use of ICTs for teaching with the interactive media form	Key use of ICTs for teaching with the interactive media form	Aligned or not aligned for each teacher practice
Communicative	Key use of ICTs for teaching with the communicative media form	Key use of ICTs for teaching with the communicative media form	Aligned or not aligned for each teacher practice
Adaptive	Key use of ICTs for teaching with the adaptive media form	Key use of ICTs for teaching with the adaptive media form	Aligned or not aligned for each teacher practice
Productive	Key use of ICTs for teaching with the productive media form	Key use of ICTs for teaching with the productive media form	Aligned or not aligned for each teacher practice
Coherence	Coherent/ not Coherent		Aligned/ not Aligned

Coherence or alignment depended on how the teacher's use scored and is later discussed in Chapter 7.

Thematic analysis is a process that involves "segmentation, categorisation, and re-linking of the database prior to the final write up" Grbich in (Bowen, 2009). Through the use of the analytical framework, themes emerged in this process and they were used to identify issues around the consistencies and inconsistences that were essential in the response to the last supplementary research question which is: *To what extent are teachers' practices consistent with the assumptions of policy?* These themes led to formation of concepts that appeared to be critical in the extent to which teachers integrated ICTs. Deductions on teacher practice - policy alliance were made based on the findings. This process continued to the seventh and the eighth chapter as deeper understandings of the value that participating teachers portrayed their use of ICTs for teaching and learning.

This phase facilitates the response to the final quest for this research, which is: *What is of ICT pedagogical value in the classroom practices of seven South African secondary school teachers?* Through the use of Laurillard's concepts and Conole and Dyke (2004), teacher practices with ICTs and the guidance of the policy framework was manifested, described and analysed. The researcher was therefore able to detect possible key content or principles for the South African teacher training course to be developed. This way, the purpose of the research question was answered.

Validity and reliability

This being a multi-case study, strengthens "the precision, the validity, and the stability of the findings" as the researcher generalises "from one case to the next on the basis of a match to the underlying theory, not a larger universe" (Miles and Huberman, 1994:29). The methods and methodology adopted in this study as described above demonstrate this complexity in trying to understand how teachers teach with ICTs in a way that brings pedagogical value through Laurillard's (2002) CF.

Validity is an aspect in qualitative research that helps determine if findings are accurate from the researcher, participant or reader (Cresswell and Miller, 2000). It serves the purpose of establishing if findings are true or not based on the stance the researcher takes. Janesick, (2000:393) believes "Validity in qualitative research has to do with description. In other words, is the explanation credible? In addition, qualitative researchers do not claim that there is only one way of interpreting an event". Credibility of findings for this study is witnessed in the thick descriptions and the quality of evidence provided in Chapter 5 and 6. The researcher has also transcribed teachers' responses verbatim by including all their articulation. This can be seen in the transcriptions in the quotations in the presentation of data in Chapter 5. The detail provided in the descriptions of the observations also adds to the credibility of this research. The use of the analytical framework developed from Laurillard's CF and her media forms and the ICT affordances from Conole and Dyke' (2004) taxonomy is contextualised to suit conditions in South African township secondary schools. The analysis is therefore confirmable as it is grounded in the data (Guba and Lincoln, 1985). In order to determine credibility, the researcher has presented sections of this thesis in PhD weekends and got responses from critical readers in writing retreats whose responses have helped to identify weak points in the presentation of the analysis and findings of this study.

Reliability is the extent to which the findings are consistent (Punch, 2009). The researcher collected all the data on her own and the participants would therefore have not been affected emotionally and

end up compromising the quality of their performance. To measure reliability of the conclusions made in this study, the researcher used an inter-coder reliability check. She requested a PhD student to assess the dependability of the data interpretations. In order to reduce error in the use of the instrument, concise indicators were used to avoid ambiguity (McMillan and Schumacher, 2006). The scope of the inter-coder reliability therefore consisted of the media forms and their description as sub-categories as constituted the analytic tool that was used to interpret all data for this study. These formed the protocol that the PhD student could use to check the reliability of the data analysis. According Hodson (1999), 10% of the data is sufficient for this check. Out of the seven teachers therefore, a random sample of one teacher's interview data transcriptions was made by the student. The researcher explained the protocol to the student so she could make informed decisions or judgements in the coding process. Although the student coded the whole transcript, samples of her coding are captured on the table presented in Appendix D. Her decisions on the interpretations agreed with four of the five media forms except for one, the Narrative, and the reason for the disagreement is given on the table (See Appendix D). The agreement score awarded was therefore 80%. This coefficient reflects a high degree of reliability (Neuendorf, 2002; Hodson, 1999).

Consistent input from the supervisor on the writing contributed to the validity and reliability of this study as weaknesses were pointed out and resolved during consultations.

Ethical considerations

It is imperative that the researcher "abides by the principle of informed consent" (Scott and Morrison, 2007:88) and sticks to research ethics (McMillan and Schumacher, 2006). Before embarking on the collection of data, the researcher applied to the University of the Witwatersrand ethics committee for ethics approval by submitting her research proposal. The committee verified the study's ethical credibility and approval was granted so she could proceed with the investigation. The letter of approval with the protocol number can be found in Appendix B

If data is collected from a school, "careful attention is paid to the various levels of power within the organisation" (Scott and Morrison, 2007:88). Data for this study was carried out in government schools and in one independent school. After submission of a consent letter stating the intentions of the study, consent to collect data was sought and granted by the Gauteng Department of Education (GDE) through a letter through a signed consent form. The GDE letter of approval is in Appendix B.

Once schools were identified, permission to gain access to each institution was sought by issuing principals with a letter explaining what the research purpose was, who could be the prospective participants, what the study entailed in terms of methods to be used to collect data and the times of engagement for those involved. The letter also stated that the name of the school and all involved would remain anonymous in the writing and presentation of the report. Pseudonyms were going to be used. The principals of the six schools signed the consent forms as evidence that the researcher could go ahead with the data collection process. Teachers in this study did not need technical assistance and although permission was sought to engage them, those who were available did not participate as primary but secondary sources of data. They gave information about the use of the computer laboratories as they were based there while participating teachers used their teaching rooms mainly.

The researcher distributed Information sheets to teachers, computer laboratory technicians, learners in the classrooms where lessons were going to be observed together with their parents. The sheets gave an overview of the study, a description of what the participants' involvement entailed and how their confidentiality and anonymity was going to be maintained. Consent forms were then signed by the teachers, technicians, and the parents of the learners giving permission to be interviewed (teachers and technicians) and to be observed during lessons (teachers, parents and learners). These were collected by the researcher before the data was collected. The raw data in hard copies is currently stored in the researcher's office where access can only be gained through a key she keeps safely. Soft copies in her computer can only be accessed by her, with the use of a password.

Once all ethics protocol was observed, the researcher then started collecting data from the six schools as planned.

Conclusion

The conceptual framework used in this study has contributed in making decisions on the research design and the methods used in this study. The research methods and the literature engaged also contributed in navigating through the hurdles that the researcher came across and as that was done; the techniques developed facilitated responses to the research questions in ways unexpected. This is evident in the teacher practices data presentation in Chapter 5.

The next chapter presents data the analytical framework developed for this study.

Chapter 4

The Development of the Analytic Framework

Introduction

This study is concerned about knowing the relationship between the value of ICT pedagogical integration of teacher enacted, espoused and educational policy documents in order to use it to inform an ICT teacher training framework tailor-made for South African teachers. There is a need to develop an analytical tool that can be used to collate the findings from the three data sets as has been illustrated by the triad in Chapter 1 to 3. The tool had to be concise enough to have common ground in all the data collected for this study which entails interviews, lesson observations and document analysis.

Laurillard (2002) has developed five media forms that are categorised to match key learning activities with the purpose of evaluating the pedagogical role they play in the learning process. The term 'media' in this tool mainly refers to ICTs and whenever non-digital media is used, it is stated. This research intends using her descriptions of these media forms to identify what value ICTs add to the pedagogy of classroom conversations with limited resources. In this context, teachers are the main users of technology and learners are recipients who benefit from their (teachers) utilisation of digital technology in the act of teaching in the classroom. Learners actively participate in the conversation guided by the teacher as he or she develops their concept understanding. This analytic frame is developed from Laurillard's (2002) media forms elaborated by four of the ten components of the ICT affordances advanced by Conole and Dyke (2004). Although the media forms tend to offer a categorisation that makes explicit the roles they play in the learning process, the selected four from the above taxonomy attempts to make clear what specific teaching and learning role they play in the experience. They will be used to enrich the descriptions of the forms in order to capture a wide spectrum of teaching contexts. For that reason, the development of the analytical framework begins with media forms as presented by Laurillard (2002) in the following table.

Table 4.1: Five principal media forms with the learning experiences they support and the methods used to deliver them

Learning Experiences	Methods/technologies	Media forms
Attending, apprehending	Print, TV, video, DVD	Narrative
Investigating, exploring	Library, CD, DVD, Web resources	Interactive
Discussing, debating	Seminar, online conference	Communicative
Experimenting, practicing	Laboratory, field trip, simulation	Adaptive
Articulating, expressing	Essay, product, animation, model	Productive

Laurillard (2002:90)

This study adopts the last column (the media forms) as the key feature in the framework. Some of the methods or technologies that are suggested on the table help to give ideas on what sort of evidence can be expected in the engagement of the single machine in this study's classrooms. It is imperative for this research to try and make explicit the pedagogical value as portrayed in classroom conversations when whatever available digital technology or medium in the learning activity is used. The learning experiences on the table above help to give initial understandings of anticipated pedagogical value if the technology is used by the learner. Lastly, awareness of the affordance of the technology used assists to link media potential with the type of engagement. It is for that reason that this study engages the descriptions of Conole and Dyke's (2004) taxonomy of ICT affordances. The second column includes the selected five affordances that seem to be more flexible and able to make explicit the potential of the respective media. It is through a close examination of the affordance, the evidence of how the teacher engages the affordance or its combination with other media that this study is able to determine the pedagogical value of ICT integration. For example, the narrative media affords non-linearity which is critical in making explicit the explanations of new concepts. The engagement of multimodal texts and media is therefore inevitable. Value of using the media can be confirmed when content is designed in a way that structure and connections are made easy for learners to grasp. The table that follows then becomes the main analytic tool for this study.

Table 4.2: Analytical tool developed from Laurillard's media forms and Conole and Dyke's taxonomy of affordances

Media forms	Affordances ⟶	Evidence ⟶	What pedagogical value does it add?
Narrative	Non-linear	Multimodality	Apprehending structure/ connections
Interactive	Immediacy	Immediate feedback	Exploring: misconceptions amended
Communicative	Collaboration	Discussion: class/ group	Re-descriptions of concepts
Adaptive	Diversity	Reproduction: experiment/ role play	Concretising theory: practice
Productive	Articulation	Product: animation/model	Knowledge construction

There needs to be evidence that can be recorded as an indicator or measure of significance of the role digital media has in the activity. As mentioned before, it is possible that the benefits of media depend on how, why and when they are used by the teacher and for that reason the order of the evidence is flexible. The last column makes explicit the pedagogical value based on the interpretation provided in the first three columns. The language used mainly in the last two columns is adopted from Laurillard's (2002) descriptions of the learning activities, media forms and their benefits. The arrows indicate what explains each column and they are only used in the table above to demonstrate how the content relates to each other. The next section demonstrates how content in each row can be interpreted in the context of the data being analysed.

Interpretation of the table

The interpretation needs to be clear enough to facilitate a coherent utilisation of the framework. In general, the media forms are used as themes to group possible ICT roles in the learning experience anticipated. Thereafter, the specific affordance expected, described or observed is recorded in the next column. It responds to the question, what is the technology able to do in that particular theme or media form? What the media can do might vary depending on the description of the activity or learning outcome. The evidence is basically the activity or the description of what is observable as the ICT is integrated into the teaching. That can be used as the actual indicator that the ICT affordance is playing a particular role in the activity. Finally, the question, 'what pedagogical value does it add?' makes explicit what benefit the usage brings to the teaching and learning process. Each row will now be explained in detail, beginning with the 'narrative' media form. At this stage the direct link between the CF and the media forms mentioned in the literature review is trivial. Instead, focus is on utilising concepts from both forms that have assisted in the development of the analytical framework.

Narrative media form

Table 4.3: The Narrative media form

Media forms	Affordances →	Evidence →	What pedagogical value does it add?
Narrative	Non-linear	Multimodality	Apprehending structure/ connections

The narrative media form "provides structure that creates global coherence in a text that contains many component parts. The structure provides a linear dynamic that links the components to each other via relationships, which may be causal, temporal, or motivational depending on the context" (Laurillard, 2002:91). The linearity of the media is a result of its nature that is non- interactive. That is, they cannot respond to the learner enquiry or misunderstanding if expressed. Media of that nature

includes text, graphics, digital discs and other visual material. Structural cues like headings, paragraphing, captions and locations help learners "maintain a sense of the overall structure of the narrative and hence understand its meaning" (Laurillard, 2002:92). These characteristics are considered in the design of learning materials and wherever necessary to make explicit the ICT pedagogical value in the learning event. This learning phase is linked to cognition as it provides the "structure that enables the reader to discern the author's meaning" (Laurillard, 2002:92). However, as pointed out in the literature review, it is possible that the structure might not be compatible with the reader's cognitive structure (the schema) and in the case of a learning context, the mediator's role to help make sense of the material becomes vital if the ZPD is to be reached for instance.

In the narrative form, the teacher describes the new concept while interacting with learners. As the teacher does so, he or she brings in different teaching methods, other technologies and where needed, utilises ICT affordances to enrich the conversation or the teaching experience. The teacher's use in such a case is non-linear and inclusion of "non-linearity of the web (epitomized by hypertext and the use of powerful search engines) leads to the potential for different routes through, and forms of learning" Conole and Dyke (2004:118). This effect can also be achieved offline by the incorporation of multimodal texts and multimedia either designed by the teacher or sourced from the web. The 'appearance' of media in the specific parts of the descriptions becomes the evidence that ICTs could be contributing to the conversation. It is this contribution that this study seeks to examine to see if it has pedagogical value and if not, what role it is playing.

The last column makes explicit what pedagogical value the media use brings into the content structure or and connections as the teacher presents the new understandings through the descriptions as presented in the Conversational Framework (Laurillard, 2002). It is during this learning phase that the teacher creates a learning environment and incorporates methods and strategies that can help make learning possible. In addition to that knowledge about learners, the curriculum and digital technology affordances promotes learner ability to apprehend the structure. The mere presence of these aspects, including ICTs does not guarantee pedagogical value, especially if this is not explicitly verified as the CF demonstrates.

Interactive media form

According to Laurillard (2004) the interactive media form is engaged when the learner interacts with technology or the teacher. Although the voice or speech will be the medium in the teacher and learner interaction, the media referred to in this form is digital. The user can "navigate and select

content at will" by using media such as hypertext, hypermedia, multimedia resources and web-based resources (Laurillard, 2002:107).

Table 4.4: The Interactive media form

Media forms	Affordances →	Evidence →	What pedagogical value does it add?
Interactive	Immediacy	Immediate feedback	Exploring: misconceptions amended

In the case of the teacher being the only user of technology, the experience described above is restricted to the teacher and the ICT. The question is, how do learners benefit from the teacher's interaction with the technology? The explanation that can be given is that this external experience that is not directly connected to the learner, benefits her in the sense that she or he is able to make links internally and when not compatible with her schema, she can then interact with the teacher. As the learner does so she or he gives the teacher external feedback and where it reveals misconceptions they can amended. Both the external and internal feedback occurs as the participants explore to find common ground in the understanding of the new concepts. The teacher as the mediator guides this process.

Immediacy is the "speed with which information can be exchanged via the web and email" Conole and Dyke (2004:120). Classroom dialogue also provides the same effect as the intention of the teacher-learner interaction is to get immediate feedback from each other anyhow. While the interaction between the teacher and the technology does the same, the value in the case described in the paragraph above is in the fact that it augments the dialogic exchange. In this synchronous platform, pedagogic immediacy becomes a factor in creating a learning environment where both the teacher and learners can draw more feedback from each other (Asiri, 2013). As the teacher receives feedback from the learner, he or she is able to identify misconceptions, adapt his or her descriptions to the benefit of the learner. This enables the teacher to seamlessly navigate media as he or she makes clear his or her descriptions. In a case where the interaction between the teacher and learner is not visible, it becomes difficult for the observer to detect if the interaction between the teacher and technology has pedagogical value. The visibility of the interactions enables one to identify misconceptions and how the teacher through whatever media amends them. According to the CF, this is a two way process in the sense that the learner needs to externally display his or modification of understandings as evidence that the interior restructuring of the structure is in line with the learning goal. The visibility of this interaction in this study is important if pedagogical value can be recognised and measured.

Communicative media form

Communicative media is operational at the discursive phase in the Conversational Framework where technology can be used in a class or groups to discuss debate or perform given tasks or challenges.

Table 4.5: The Communicative media form

Media forms	Affordances →	Evidence →	What pedagogical value does it add?
Communicative	Collaboration	Discussion: class/ group	Re-descriptions of concepts

Although the engagement of this media form as described by Laurillard (2002) and Conole and Dyke (2004) suggests that communication is carried out online synchronously or asynchronously, this effect can still be achieved through classroom conversation as well. Learning or communication through the ICT affordance means sending text messages using it and yet in a classroom conversation, the experience is through speech. The ICT affordance may provide a stimulus or a platform that might initiate the conversation in the collaboration process. Crook (1994:98) argues for this type of ICT use by saying,

> I would encourage a move away from design strategies based exclusively upon interacting with computers, towards solutions that consider computers as a context for social interaction. Our aims then would be different. They would no longer be directed towards displacing instructional interactions. They would be more concerned to establish how computer activities can serve as an occasion for classroom discourse: a setting in which certain kinds of potent socially organised experience can be arranged. We would be turning our attention towards the social interactional possibilities that the physical presence of this technology affords.

Although Crook's organisation of the activities in his description seems to be around computers, his argument for preservation of classroom discourse is in line with what this study advocates for even in the engagement of the communicative media form.

In collaboration, all members work towards achieving the same goal. In a classroom scenario where the technology is only in the hands of the teacher, its use can provide opportunities for re-description of the concepts as arguments or misconceptions in the group or class learning activity occur. This activity can help learners develop higher order thinking skills as they argue for or against a particular position. What is of interest in this study is how teachers are able to give this

learning experience to learners through their (teachers) use of the technology. In a case where communication is devoid of technology, its pedagogical value (the re-descriptions of concepts) cannot be associated with its presence, unless if it contributes to the conversation somehow.

Adaptive media form

Adaptive media are "computer-based media capable of changing their state in response to the user's actions" (Laurillard, 2002:126). This is different from communicative media which is characterised by external reciprocity as adaptive media uses its modelling affordance by receiving input from the user to change the model to produce the resulting output (Laurillard, 2002). The advantage of this media is that it is able to offer formative intrinsic feedback to the user. In the case of learning, intrinsic feedback is "internal to the action, that cannot be helped once the action occurs" (Laurillard, 2002:126) and can be used to build learner "understanding of the internal relations between theory and practice" (Laurillard, 2002:129). Adaptive media can also give learners an opportunity to experience various out of classroom scenarios as the teacher uses it as he or she engages them in making decisions and seeing the outcome of an action. As learners are exposed to experiences or events different from their own, their knowledge is extended beyond what they are familiar with (Conole and Dyke, 2004) in the context of the content taught. What is critical in this experience is that this experience brings about a clearer and real view of the idea taught. It is not meant to elaborate the structure as in the narrative, but to provide learners with situations that promote the internal adaptation of understandings as the technology is operated on by the teacher.

Table 4.6: The Adaptive media form

Media forms	Affordances ⟶	Evidence ⟶	What pedagogical value does it add?
Adaptive	Diversity	Reproduction: model/ role play	Concretising theory: practice

In order to help learners gain explicit understandings of an abstract concept, the teacher as the user may use representations of real occurrences or try and illustrate theoretical ideas to help learners make sense of them. This effect can be gained by using role play in a face-to-face learning environment. The aim in this case is to copy or reproduce real-life roles to give a "direct experience of the (simulated) world" Laurillard (2002: 128) in order to learn something. As the teacher gives learners an opportunity to make sense of an event or idea he or she may engage adaptive media to complement classroom conversation. When theoretical perspectives have been presented, this medium can be used by the teacher to give learners a virtual concrete experience of the concept, where it can be emphasised and by so doing give them practice that would provide them with more

profound understandings. This can be achieved to a certain extent without the involvement of this media and again, if it is accomplished without the engagement of digital technology engagement, value cannot be accredited to it regardless its presence.

Productive media from

Productive media gives learners an opportunity to create their own products as they articulate their conceptions (Laurillard, 2002) of the descriptions of the world. It is when learners have acquired adequate skills that they can productively engage with this media in either a digital or non-digital form.

Table 4.7: Productive media form

Media forms	Affordances →	Evidence →	What pedagogical value does it add?
Productive	Articulation	Product: animation/model	Knowledge construction

In the productive phase, teachers might involve learners in an activity where they can utilise what they have learnt to create a particular product. In this case authentic challenges might be used and the ICT affords learners to articulate or work on the activity online to produce new knowledge.

Learners in this study generally do not use computers and for that reason, they can use other productive media like paper to achieve the same purpose (Laurillard, 2002). However, as in other media forms, the teacher's use of ICTs might help to expose learners to other ideas they could probably implement with non-digital media as they construct new knowledge.

How the analytic tool is used

As the role of the ICT affordances is described in each occurrence, the Conversational Framework's learning activities is used to indicate where the impact is being made in the learning process. That should help in establishing a set of descriptions that are likely to occur when the media form is engaged. For instance, if the teacher is introducing a topic, the discursive learning activity will be at play and for that reason as the teacher interacts with learners in the development of the concept; different multimodal texts can be integrated into the conversation. As this happens, the non-linearity ICT affordance can be engaged. The structure and its links can be established through this process. The media forms are not only engaged for the sake of their affordance but so that where speech for instance is not enough or capable to make explicit the descriptions, the ICT can come in and make vivid the feature in question. Links can be made between parts of the content structure or between

other media or texts to help learners see how the ideas come together or relate. When that is achieved, the use of ICTs is of pedagogical value.

As Laurillard (2002) has pointed out that a complete cycle of the learning activity makes up a complete and well consolidated learning experience where the learner is able to transfer acquired knowledge to other situations, due to different learning goals and circumstances, this progression might not be completed. However, what matters is that learning has taken place and the learning goals have been achieved, based on the evidence displayed.

It is expected that some teaching and learning experiences might not match the content on the framework and the reason could be that non-digital media is used instead of ICTs. When that happens, that is recorded as is. In a case where the media form is not engaged at all in any media, which is stated as 'none'. Such information is critical in the understanding of the teacher's type and extent of integration and how it relates to other teacher practices.

In the case of espoused practices, what the teachers say is recorded as implied and as displayed in the enacted practices above. Where there are mismatches with the framework, this will be indicated and described.

This analytical framework helps maintain the same description and understanding of the ICT pedagogical value as portrayed and demonstrated in the teacher practices. These will later be matched with the South African education policy to determine the extent to which they comply with them.

Conclusion

While Laurillard's (2002) media forms were initially developed to demonstrate how learners can benefit from their use of ICTs, the discussions offered for each form above have attempted to illustrate how teachers can use them to give the same or similar learning effects. Emphasis in the discussion was on demonstrating how classroom conversation facilitated by the teacher as he or she engages different media and uses feedback from learners during the interaction can be enhanced by his or her use of a form of technology affordance. The main thing is that learners are able to have the same experiences through meaningful ICT enriched conversations. Variables in the implementation of ICT pedagogical integration differ per teacher and it is hoped that the use of this

analytical framework will help identify themes that can be synthesised and used to make decisions on the ICT teacher training framework to be developed.

The described analytic tool is used to analyse the contextual elements in the conceptual framework: the policy, espoused and enacted practices. There after the analyses are collated to facilitate the emergence of key findings that should inform the development of a generic teacher-training framework that will cater for teachers in all South African schools, especially those with limited resources.

Chapter 5

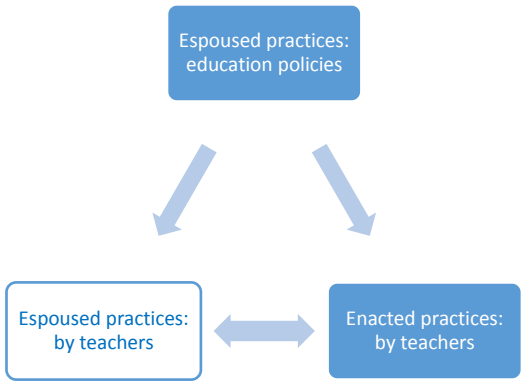
The Value of Teacher ICT Integration into Teaching

Introduction

This chapter is aimed at providing data, interpretation and analyses in order to respond to the following research questions:

1. What is deemed to be of pedagogical value by teachers in their own espoused with ICTs?
2. What is implicitly assumed of pedagogical value in the teachers' enacted practices with ICTs?
3. To what extent are teachers' espoused practices reflected in their enacted practices?

The figure adapted from Figure 1.8 in Chapter 1below illustrates the data that will be the source of discussion in this chapter and highlight emerging features in both espoused and enacted practices. The reflection of the pedagogical value that the policies have on the teacher practices will be dealt with in the next chapter.



This study seeks to understand the triad above by giving and analysing the description of each component in the context of identifying ICT pedagogical value and how it relates to the other parts. Literature (Ertmer, 2005; Wozney, Venkatesh, and Abrami, 2006) has demonstrated how the relationship between espoused and enacted teacher practices influences the extent to which teachers integrate ICTs. Incidentally this research will find out if the results from other countries are the same as those in this South African study in that regard. It is expected that since the educational policies as espoused practices are unique to South Africa, both teacher practices will reflect these

local guidelines and by so doing endorse the framework to be developed as tailor – made for this country. The following table gives an outline of the teachers participating in this study.

Table 5.1: Extended teacher profile

Teacher names with translations	Subject taught	School	Years of teaching experience	Years of teaching experience with ICTs	Qualification
1. Mshini (Machine)	Physical Science	A	6	-1	Bachelor's Degree in Education
2. Sizakele (Convenience)	English FAL	A	5	3	Advanced Certificate in Education
3. Takalani (Be happy)	Geography (1)	B	37	1	Bachelor's Degree in Education
4. Mpetha (Expert)	Mathematics (1)	C	10	1	Bachelor's Degree
5. Mlingani (Partner)	Mathematics (2)	D	3	2	Bachelor's Degree
6. Moruti (Teacher)	Geography (2)	E	25	5	Bachelor's Degree
7. Bambisana (Cooperate)	Geography (3)	F	26	1	Bachelor's Degree in Education

This study is built on the premise that teaching is a conversation and it accepts that Laurillard's (2002) Conversational Framework makes vivid the development of learning through this learning activity. Whereas acknowledging the learning activity as evidence of the value ICTs add to teaching, Schulman (1987) argues that teacher beliefs or what they embrace about their practice actually directs their actions in the teaching process. Ertmer (1999) extends this view in her claim that teacher beliefs influence the extent to which teachers integrate ICTs. This chapter therefore uses teacher beliefs (espoused practices) to understand what principles teachers have that could be of influence to their behaviour as they integrate ICTs into their teaching, their conversations (enacted practice) in such a way that they bring value to their teaching. In other words, what pedagogical and or technological beliefs drive their choices or decisions as they decide on what representation of the world to engage or ICT affordance to integrate into their conversations?

In order to make explicit the difference that ICTs make in the classroom; whenever this study refers to conversation it denotes the verbal interaction or presentation, teaching methods, teaching strategies and non-digital technology. In other words, it refers to that which constitutes pedagogy. The aim of this study is to examine how ICTs enhance this conversation. As has already been pointed out in the literature review, classroom conversation or dialogue does not refer to the voice or spoken word but all that is used in the classroom to communicate the message (Romiszowski, 1988). To extend the understanding of teaching as a conversation, Dron (2012) adds that it is an amalgamation of different teaching methods and teaching resources to help learners learn. In some

cases in this study, this view is referred to as conventional teaching to try and hypothetically detach the activity so that in the description the impact or the value of ICTs can be visible. The following description of the analytic tool explains how ICT pedagogical value is recognised in the interpretation of the espoused and enacted practices.

How the analytical framework is used for each teacher practice

The following analytic tool has been explained in the analytical framework chapter and the description of how it has been used for each practice is expounded in this section.

Table 3.2: Analytical framework

Media forms	Affordances	Evidence	What pedagogical value does it add?
Narrative	Non-linear	Multimodality	Apprehending structure/ connections
Interactive	Immediacy	Immediate feedback	Exploring: misconceptions amended
Communicative	Collaboration	Discussion: class/ group	Re-descriptions of concepts
Adaptive	Diversity	Reproduction: model/ role play	Concretising theory: practice
Productive	Articulation	Product: animation/model	Knowledge construction

Espoused teacher practices disclose what teachers believe is of pedagogical value in their use of ICT affordances in the classroom. What the teachers perceive as ICT affordances that enhance the teaching and learning in their practice is reflected in their responses to the interview questions. The types of media forms have been categorised in the analytic tool and the interpretation of teacher responses is used to place each teacher's belief on the ICT affordances they perceive to be of pedagogical value. As teachers give examples of what they do with digital technology, this is taken as evidence for the pedagogical value they seem to assign to the technology affordance. The espoused practices are followed by an exanimation of how teachers actually use ICTs to augment their teaching.

The enacted teacher practices are based on the single lesson of each teacher observed by the researcher. Five of the teachers use a laptop and a data projector and the remaining two use an ibox (combination of a computer and a projector in one machine). Although the teachers use different digital gadgets, the applications they utilise are either Microsoft Word or PowerPoint to present their lessons. The ibox used by two teachers in this study had Mathematics and Science material designed by the technology sponsor. It is for that reason that Takalani does not have ready-made content for his subject (Geography) in the ibox and uses this technology to summarise topics covered and for formative and summative assessment. The other teacher Mpetha uses the ibox, to teach and for formative assessment. Mshini and Sizakele use material from the internet and modify it where and when necessary. Moruti and Bambisana use slides from the department of education

that they modify to suit their teaching needs. Mlingani is the only one that uses a CD from the department of education.

The 7 teachers in this study are all teaching during the observed lessons but they are engaged in different descriptions of teaching stages in the Conversational Framework. In each of the cases, teachers have conversations with learners as they work towards achieving their learning goals at different levels.

In order to use this analytic tool meaningfully, a narrow column has been added after the affordances and evidence column to indicate if the available ICT was used as the respective media form during the observed lesson. The reason why this is done is because this study also seeks to demonstrate that although ICTs may not feature in the media forms, teachers through conversation are able to achieve more or less the same outcome. In other words, non-use of the digital technology does not deem one a bad teacher, and yet usage that is learning goal oriented is bound to powerfully enrich the learning experience as anticipated learning barriers are overcome and the teacher's teaching is enriched. The tick '/' therefore indicates that the ICT affordance has been used directly or operated on at the description level of the table cell. The 'x' depicts absence of ICT usage for the cell description. In italics, a brief description or phrase is given to indicate how or how not the cell description was demonstrated in the lesson observed with or without ICT usage. The implication is further explained below the table. After the explanation in the last column, the additional one indicates if the pedagogical value can be accredited to the ICT used or not.

Table 5.2: Analytical framework customised for enacted practices

Media forms	Affordances		Evidence		What pedagogical value does it add?	
Narrative	Non-linear		Multimodality		Apprehending structure/ connections	
Interactive	Immediacy		Immediate feedback		Exploring: misconceptions amended	
Communicative	Collaboration		Discussion: class/ group		Re-descriptions of concepts	
Adaptive	Diversity		Reproduction: model/ role play		Concretising theory: practice	
Productive	Articulation		Product: animation/model		Knowledge construction	

As espoused and enacted practices of each teacher is presented, an analysis of these follows to bring to the fore elements that can be used as emerging themes for discussion in the discussion chapter, Chapter 7.

It is through the analytical tool that this study is able to determine usage that is of significant pedagogical value and that which is at low pedagogical value. It is important to take note of this factor in order to demonstrate, consistency has nothing to do with whether there is value in the use of ICTs or not and to justify the decision taken on consistencies. If the value is high (H) it means

there is evidence that learning is improved by the presence or the use of the digital technology, based on the last column of the table (the framework). If there is no evidence, then the value is low (L).



Mshini

Teacher description

Mshini is a physical science teacher in School A and although the school has the type of gadgets he uses, he prefers to use his own. This teacher has not received any basic computer skills training but has learnt from observing others and asking colleagues and friends whenever he needs help.

His value for digital technology is based on its affordance to deliver or display much content within a short period of time. He says,

> *Especially, Ihmm, sometimes when you find there is too much work when you got to cover. It may be one way to try, to try and speed up. Yah, because if you have got to draw diagrams it will actually take time to draw those diagrams so it can show learners as much as possible.*

Delivery of content is related to acceleration of the teaching process especially where producing subject representations is slow. ICTs seem to provide Mshini with more platforms and text modes. Pedagogical value in terms of benefit for the enhancement of classroom conversation is not explicit in this response. The teacher's understanding of ICT integration somehow seems to relate to the above response. He says,

> *It's probably trying to may be do things that you would not be able to do, like if you want to show illustrations. That will probably be yah, there can be simulations that you can maybe adapt.*

Inability to do what ICT use does can be linked to mass production or content coverage made possible by affordances that can make available different forms of content representations. This could also be giving credit to the immediacy of digital technology over traditional resources like writing with chalk on board within a short period of time. His value for ICT use therefore seems to be limited to technology supporting his delivery of content.

The analytic framework will now be used to indicate how his beliefs relate to the pedagogical value as viewed from the media forms. The tool is supposed to make explicit how his beliefs about his ICT usage can be considered as of pedagogical value. What the teacher believes is paraphrased and typed in italics and placed in the relative cell on the framework.

Espoused practice

Table 5.3: Interpretation of Mshini's espoused practices

Media forms	Affordances	Evidence	What pedagogical value does it add?
Narrative	Non-linear *Display of different representations in one session*	Multimodality *Different modal texts used*	Apprehending structure/ connections *Different representations of content are presented to explain concepts*
Interactive	Immediacy *Access to many different modal texts at any given time*	Immediate feedback. *Feedback as in the case of displaying questions and answers whenever needed in the teaching*	Exploring: Misconceptions amended *Provision of different modal texts facilitates amendment of misconceptions.*
Communicative	Collaboration *None*	Discussion: class/ group *None*	Re-descriptions of concepts *None*
Adaptive	Diversity-Direct link with the world *Source of diverse material that can be modified*	Reproduction: model/ role play *Animations by teacher*	Concretising theory: practice *Making theoretical ideas explicit for better understanding*
Productive	Articulation *None*	Product: animation/ model *None*	Knowledge construction *None*

Narrative

The fact that Mshini says he is able to use different modal texts when using ICTs indicates that he could be integrating these in his classroom conversation. When this is done, there is non-linearity in the use of the affordances if they are used interchangeably with other teaching methods or technologies and by so doing enhancing the presentation and apprehending of structure. For instance, when asked when and how he uses ICTs he says,

> *I used it to draw graphs in the computer lab.*

This is an example of a case where he will be engaging different modes of texts to narrate content and therefore supplement his subject world descriptions.

Interactive

Interactivity here is based on the interaction with technology as he says,

> *It may be one way to try and speed up. Yah because if you have got to draw diagrams it will actually take time to draw those diagrams. So it can to show learners as much as possible.*

His value for ICT use is also based on the technology's ability to give immediate access to content, thereby making it possible to show much content within a short period of time. Mshini does not indicate how he interacts with his learners through his use of ICTs. It can only be assumed that the nature of content displayed supports the conversations. For instance, the following response does not make explicit how the conversation is enhanced:

> *I used it mainly for questions just to show questions on the screen and sometimes the answers.*

The fact that the teacher uses the article, 'just' could indicate that he is aware that what he does has little pedagogical value. However, that does not mean learning is not taking place as the display could be used to initiate conversations. Learners and the teacher can then interact and misconceptions can be rectified in this process.

Adaptive

Mshini values ICT use as a source for teaching material which he modifies as he says,

> *I usually do them (materials) on my own, or find what is already available and just modify.*

Contrary to his earlier use of 'just', this time he seems to imply that it is easy for him to do it. In addition to that benefit, Mshini includes simulations that he says he adapts, an indication that he takes advantage of the adaptive media form as it allows him to adapt content representation to support his teaching.

> *That will probably be yah, there can be simulations that you can maybe adapt. Or if there is an experiment yah, just when you are demonstrating a simple experiment. Sometimes there are flow diagrams.*

What he says seems to have pedagogical value in the sense that his teaching is enhanced as he is able to concretise and perhaps contextualise theory through these adapted versions of subject matter. This affordance is valuable to learners in such a school with limited resources.

Conclusion

What is significant about this teacher's belief about the pedagogical value he places to his use of ICTs is that he is able to complement his teaching in the sense that he can perform beyond expectation. He perceives ICT affordances as limited to immediacy, non-linearity and diversity as

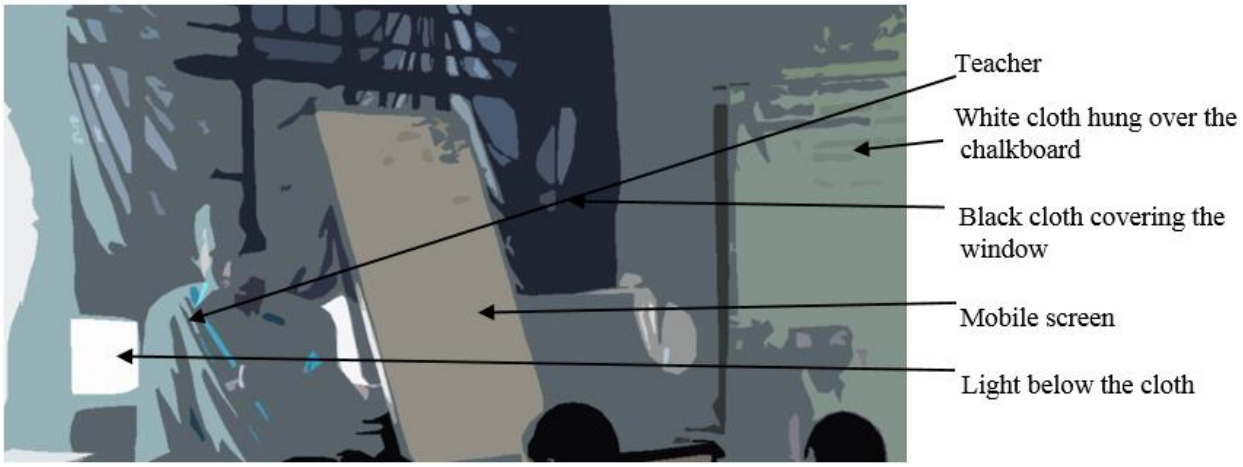
they are able to compensate for limited non-digital resources or teaching methods, saving time and presentation of much content in any given moment. There is no indication in his responses that he engages learners in collaboration or that his use of technology contributes to learner articulation of tasks. However, that does not mean he does not incorporate these media forms, as he could be using them with non-digital media in the classroom conversation.

Enacted practice

Mshini uses his own laptop and a data projector to teach physical science to a Grade 12 class in his big science laboratory accommodating about forty learners during the lesson observed.

The laboratory does not have blinds or curtains to prevent light from coming into the classroom and as a result learner view of the slides during the lesson is fuzzy. He therefore uses black pieces of light material that are not as effective and light can penetrate through them. The material is also a bit shorter than the window and allows some light to infiltrate through. Instead of a screen he uses a white piece of cloth covering part of the green board in front of the class. The picture below shows the set up around the display of the content. To allow easy movement as he presents his content, he also uses the small white board next to him to write on. The laptop is positioned just in front of him.

Figure 5.1: Mshini's classroom setup



In all, information is displayed on four different places. The projector is used to project questions from a Microsoft Word document onto a white cloth stuck onto the front wall and the mobile screen next to him displays answers or solutions to a task given the previous lesson. He uses the uncovered side of the chalk board as an operational platform where texts can be written and erased when not needed or to make way for new text. The fourth platform is a whiteboard at the back of the laboratory displays the same answers that were on the mobile screen. Content in all these platforms

are used or referred to during the lesson as he teaches. Basically Mshini seems to use digital technology as an additional content presentation platform so he can give learners access to more and at times different information. Both digital and non-digital technologies seem to complement each other as the teacher directs focus on one to the other. His conversation is either augmented by or initiated from the text displayed on some platform. The lesson and the learning activities for this lesson that follow provide a background from which Mshini's enacted practice will be analysed.

Lesson observed

Topic: Chemical reaction and structure - revision

ICT used: laptop and projector

Overview of the lesson

This is a revision lesson and to begin it, Mshini goes through answers of an exam paper projected on the wall, giving explanations and tips on how to answer questions, while learners correct theirs and listen at the same time. The purpose of this lesson activity is to give learners feedback and to help them adapt to the concepts covered as the teacher amends misconceptions and offers re-descriptions on the content. He also gives them tips on how they should respond to questions, in the process enriching their understanding on specific aspects of the concepts covered. The first 14 questions covered demand one word or short answers and as a result the teacher spends 9 minutes 7 seconds on them. At this first stage of the lesson, the teacher interacts with the learners as answers are given. Whenever an answer is given, whether wrong or right, the teacher elaborates on it. This re-description that comes as a result of the teacher's reflection on feedback he gets from learners takes the form of what Laurillard describes as the interactive stage. In this case, the teacher seems to play the role of a master teacher (Burbules and Bruce, 2001) as he checks and directs learners to the appropriate learning goal.

The rest of the time is spent on number 15 which focuses on chemical structure for unsaturated and saturated chemical solution. After explaining other teaching methods and strategies like examples and linking the concept taught with prior knowledge, the teacher then selects part of the question projected on the wall and asks learners to come and draw the structure of the 5 types of alcohol on the chalkboard. This becomes a class activity as learners help each other to come up with the correct answers. He asks learners to justify their decision making and as they do so, he corrects them where there are misconceptions.

The screen serves as a fixed platform to initiate this activity that is driven by the interaction between learners and the teacher. The pedagogical value of the use of technology in this activity is demonstrated on the analytic tool below.

Table 5.4: Interpretation of Mshini's enacted practice

Media forms	Affordances		Evidence		What pedagogical value does it add?	
Narrative	Non-linear *Display question discussed – referred to when needed*	/	Multimodality *Written text on screen and representation of chemical reaction on board*	/	Content structure/ connections *Formulas and steps to take when working out solutions (chemical reactions) written on the board*	×
Interactive	Immediacy *Instant availability of questions (stimulus) from the display*	/	Immediate feedback *Conversation used*	×	Misconceptions amended. *Through learner responses, the teacher is able to amend misconceptions.*	×
Communicative	Collaboration *No ICT affordance used for this purpose*	x	Discussion: class/ group *At class level*	x	Re-descriptions of concepts *As learners give answers, re-descriptions are offered and endorsed by the teacher. I*	x
Adaptive	Diversity *Display of questions for revision*	x	Reproductive: model/ role play *None*	x	Concretising theory: practice. *Learners had an opportunity to apply what they had been taught by writing solutions on the board.*	x
Productive	*Articulation* *None*	x	Micro worlds *None*	x	Knowledge construction *None*	x

Narrative

The available technology is only used to display the question on the platform portrayed on the Figure_ above and is used as a starting point for the explanation on how saturation should be tested. The fact that all learners have access to the same text at the same time seems to promote multimodality that is concentrated on non-digital technology. For instance, in order to enrich the explanation, the teacher writes on the chalkboard, formulas using chemical symbols and calculations to illustrate the process. He also uses the analogy of tea in the next extract to support his explanation:

> *Like tea. By the time you get to the 6th teaspoon, that will not dissolve because the solution is now concentrated. What does it mean by that? (pause) It means that there are only bonds maximum hydrogen atoms or carbon atoms. No colour change…*

After this, Mshini goes to his laptop and opens a word document with the task and tells them to look at it. Thereafter he goes to the chalkboard and writes the heading, 'LUPAC Structures Formation' and underlines it. He then carries on explaining how the formation should be tackled. It is evident that the use of the digital technology is on the background and remains there while other teaching methods and non-digital resources are used. Therefore credit for apprehending structure and adapting to re-descriptions cannot be given to the digital technology used and yet this was accomplished through the use of the voice and other non-digital media. Projecting the task on the wall does not provide a distinctive role as many other media (non-digital) can do the same. The

responses from learners seem to determine the direction of the lesson as the teacher enriches explanations by engaging different representations of the concept taught and by so doing, enabling non-linearity through non-digital media.

Interactive

In the teacher's effort to make available the task to the whole class in an instant when he needs it, he is able to utilise the immediacy affordance of the technology. Although this affordance contributes to the orchestration of the pedagogy, its impact is not distinct to ICTs and yet its immediate access seems to make the flow of the conversation seamless as the teacher does not pause at any moment to write the question but simply points it to them. The following extract from the observation on the test for saturation demonstrates this point:

Teacher: How do you see the reaction has changed?	*(No Answer)*
Teacher: Things like what that you can see?	*(Re-description)*
Learner 1: Changing colour.	
Teacher: Changing colour and what?	
Learners (a number of them): Changing temperature.	
Teacher: Changing temperature?	
Learners: Changing. Test.	*(Misconception)*
Teacher: Although we don't test	
(Goes back to the board and writes as he explains)	*(Re-description)*
Teacher: What happens to the double bond?	
Learners: (Learners give a chorus answer)	*(Modified action)*

He continues:

Teacher: In this one there is a colour change and in this one there won't be any colour change. So this is an experiment to test for saturation.

(Teacher goes back to the board and writes a compound for a saturated bond)

Teacher: It's more like when you are making tea. (Humour). You like tea Nthabiseng and Sipho. Your sugar, like Nthabiseng who wants to pour 10 spoons. When on the 6th, it means you are on the 2nd box (points at the illustration on the board) Colour change. No colour change no reaction. That's what will guide us.

(Teacher moves to the laptop and opens the document that was no longer projecting)

Teacher: This is what I gave you as classwork.

(Teacher then moves to the board and writes as he writes the title: 'Structural Formula' as he continues with the conversation)

This interactive activity takes 5 minutes and the laptop is used once, just to show learners the task. In fact, during the whole lesson that took an hour, the teacher-technology interaction occurs 4 times and each time the teacher uses the projection as a starting point for the conversation.

This learning activity seems to operate through conversational engagement where the technology projection is at the level of visual reference (looking at and reading the text). This is done whenever the teacher wants to highlight relevant aspects in his explanation or make task available to all learners at the same time.

Communicative

ICTs were not used for the above media form, but engaged minimally with non-digital media at class level as learners assisted each other to draw chemical structures of alcohols in the question. As this was done, re-descriptions were given by both the teacher and classmates as follows:

Teacher: (Writes 5 alcohols - A-E that learners must draw on the chalkboard)

5 learners go to the front and the conversations start as they star working.

Sitting learner 1: There is a problem with D. There should be 3 carbon. Ubhale (Zulu – you wrote) 4.

Teacher: (Keeps quiet and watches)

Sitting learner 2: It's correct (she explains)

Sitting learner 1: Oh, sorry sir. It's my mistake.

When the 5 learners have finished, the teacher takes over and together with the class, to correct misunderstandings. The teacher offers re-descriptions in the process.

Adaptive

This media form is mainly engaged at the conversational level. The projection on the screen is only used to refer to the questions that are used to give learners practise on formulating chemical reactions. The extract above suffices to demonstrate how learners are given time to practise the theory. The teacher also uses real-life experiences to help learners adapt to the concepts he is teaching.

Conclusion

There is an indication based on the evidence made possible by the use of the Conversational Framework that the learning activity guided by Mshini 'gives birth to learning' (Laurillard, 2002).

His teaching revolves around the interactive process whereby "teacher and student at the level of task environment, setting and aiming to achieve the task goal, giving and acting on feedback in the light of the task goal" (Laurillard, 2002:86). The immediacy of the ICT affordance plays a trivial role in the development of the learning process and yet its contribution to the orchestration of the process promotes pedagogical immediacy in the realm of classroom conversation. One might argue that the insignificance of the integration does not deem usage as of pedagogical value, but ruling out its affordance could be a dismissal of this capability in the context of teaching. There is therefore a need for a suitable description of this kind of ICT integration and the value it has on teaching.

Analysis of coherence of teacher espoused and enacted practices

In order to determine or rate the value of ICT integration into the teaching of Mshini, there are premises that need to be taken into consideration in relation to this teacher's practices. The first one is clarity on what is meant by a media supporting teaching. While pedagogy entails that which makes learning take place in this context, what can be described as augmenting it is that which, in the context of the Conversational Framework, alleviate the difficult task of mediating academic knowledge. The second premise is that the teacher's espoused practices encompass his beliefs for ICT pedagogical value and that they do not necessarily have to appear as is in his enacted practice. What the teacher does in the classroom is driven by the lesson outcome or the task goal in this case and for that reason, all the media forms or affordances indicated in the beliefs do not necessarily have to be engaged in one lesson. The focus will therefore be on examining what the teacher's approach is in his use of ICTs. In other words, does it have potential to improve teaching and if it does, is it based on his ICT usage that counts as evidence.

To begin with, there is a need to know what seems to influence the approach the teacher uses to integrate ICTs, based on his beliefs. Mr Mshini has high regard for ICTs in making him efficient in his teaching. His description of this effectiveness is in terms of providing resources that he can adapt to suit learning objectives and to display texts that he integrates into his conversation as he interacts with his learners. Based on his task goal, Mshini draws from the immediacy ICT affordance in his teaching. Much as the affordance is around its practical use as a tool for giving access to all learners at the same time, this type of use promotes an accelerated and efficient conventional teaching. What needs to be emphasised is that the use is not directly linked to learner cognitive development as they, for instance do not have to know or remember where the questions and answers were displayed to acquire knowledge. Secondly, the display does not help to create an environment that enhances the understanding of concepts. The easy accessibility of the questions

serves as a mere platform and yet its position in the lesson development helps to promote pedagogical immediacy and non-linearity that is constituted in the interactive learning activity.

In his espoused practice Mshini emphasises ICT value in terms of delivery of much content, this is not reflected in his enacted practice. The display of different types of materials (questions, answers – on 2 platforms, processes) seems to be his understanding of ICTs helping him 'do what cannot be done' and 'speeding up' teaching. In his actual teaching he used the ICT in the form of written text and other texts were not incorporated. There was no indication that Mshini had modified the word document he projected from his laptop either.

Both media affordances engaged in the enacted practice were at the level of classroom conversation. In other words, it was the teacher's teaching (the conversation) that portrayed the affordance in a significant way and the ICT simply or 'just' (as the teacher indicated in his espoused practice) added to the existing non-digital teaching resources. His belief about ICT use is external to cognitive development and this is reflected in his teaching. It is also evident that his failure to engage the ICT affordances to the benefit of the actual learning does not mean his teaching is ineffective. His effectiveness is actually seen in the way he creates a learning environment that has pedagogical value through conversation in the classroom.

Overall conclusion

The enacted practice did not display much of what Mshini claims he does with ICTs. A display of 1 word document with questions cannot be considered as usage that helps deliver much content with ICTs. What is evident is that this teacher makes the display part of the many displays he has. It does not mean he accesses more content from the technology. Mshini's espoused practice gives the impression that he does much with ICTs in the narrative in particular, but in his enacted practice as already been pointed out, not much of it is engaged. Therefore, the fact that Mshini's pedagogical value for the espoused practice is high and for the enacted practice is low, makes them inconsistent.



Sizakele

Teacher description

Sizakele is an English First Additional Language (FAL) teacher who also teaches in School A. He uses his own laptop and data projector to teach. Sizakele acquired his computer operational skills at a local (South African) university where he qualified for an Advanced Certificate in Education in the field of ICT.

He finds the use of the ICT very convenient because he does not have to waste time before the beginning of each lesson writing teaching and learner notes at the beginning of each lesson. He finds setting up the projector in particular; time consuming as he has to make sure it is well adjusted to the screen area before he starts projecting his notes. He does not ever take learners to work from the computer laboratory because they do not have basic computer skills and the class numbers are almost double the number of computers available for learner use anywhere. He mainly uses the ICT when he has notes to give or show and downloads teaching materials from the internet.

Espoused practices

His value for ICT use is basically based on its benefit in performing his teaching duty efficiently under the circumstances he is working from. The school timetable requires that he moves from classroom to classroom for his lessons. This makes it difficult for him to display whatever teaching content for the respective classes. The mobility of the laptop has helped him to save on teaching time. He explains,

> *So, I don't have to write them time and again. For instance, if I was using a chalkboard, I write notes today on the board, they (the learners) don't finish, somebody comes and erase. So, when they come I need to rewrite. So to me, I find it convenient cause it serves my time.*

This convenience, brought about by the mobility of the ICT seems to be of much value in his content delivery.

When asked what his understanding of ICT pedagogical integration is, the teacher describes an online learning environment by saying,

> *Um. It would mean that learners should be able to be given instructions through the computer; be able to carry them out; work confidently with the computer without any*

doubts. So… and uh, activities, also. They should be able to access them through computer. Perhaps even submitting them, even getting feedback – it should actually be through that.

This description resembles that of a distance online learning platform because it does not indicate what his role as a teacher would be or how he would use the technology in the traditional classroom.

The teacher seems not to be aware of blended learning or the fact that he could engage its diverse affordances to augment his face-to-face teaching. His justification for not advancing his use is that learners do not have ICT skills so that they can learn through ICTs. It is possible that this view is influenced by the understandings he acquired in his tertiary ICT training. However, the following table will help try and understand the pedagogical value Sizakele assigns to his use of ICTs in the classroom.

Table 5.5: Interpretation of Sizakele's espoused practices

Media forms	Affordances	Evidence	What pedagogical value does it add?
Narrative	Non-linear *Linear - Display of notes for copying*	Multimodality *Mono-modality - Written text*	Content structure/ connections *Displaying and copying of- key elements in the structure*
Interactive	Immediacy *Instant access to teaching and learning material*	Immediate feedback *Quick response to questions by learners*	Exploring: Misconceptions amended *Efficient response to feedback promotes timely amendment of misconceptions*
Communicative	Collaboration *None*	Discussion: class/ group *None*	Re-descriptions of concepts *None*
Adaptive	Diversity *None*	Reproduction: model/ role play *None*	Concretising theory: practice *None*
Productive	Articulation *None*	Product: animation/ model *None*	Knowledge construction *None*

Narrative

Since Sizakele uses technology merely to display notes on the wall for learners to copy, there is no indication that the usage is integrated with other media or modal texts, therefore suggesting that his use might be linear. When asked when he uses ICTs, he says,

Normally when I've got uh, some notes which I want them to copy, to translate in their books. Since we have a problem with uh, the printing: they sometimes restrict us to print in bulk. So to avoid wasting time – writing notes for them on the chalk board, I simply use, um, the projector.

The notes serve the purpose of making clear and to establish the grammatical structure of the language. Sizakele seems to suggest that all he does when notes are displayed is,

> *explain what the notes is about*

That saves him time in a way. Value for the use of ICTs in this case is and determined by its technical affordances and nothing about the actual teaching. It is therefore difficult to detect its pedagogical value in the teaching process except that he is able to provide them with notes as the responses do not indicate how learning benefits from his use of the ICT.

Interactive

Interactivity seems to be during Sizakele's presentation of notes as he interacts with the computer. The ICT immediacy affordance remains at technical level, that is, the instant access to notes. He adds,

> *I do not write notes in the presence of learners. So when they come I only display them and explain what notes is about. So it saves time.*

Although Sizakele demonstrates how the affordance alleviates his teaching, the value is technical as it is associated with time as it affords immediacy. He seems to associate computer use with competence in learning as well. For instance he believes,

> *…when they (learners) use computers they are able to like, ah, do it (answering questions that are complex) quicker and faster.*

The assumption seems to be that the use of computers by learners facilitates quick thinking and facilitate prompt feedback from them. Although interaction in the Conversational Framework promotes amendment of misconceptions (Laurillard, 2002), in this case, the value of the use of the computer is only related to efficiency in terms of time spent on teaching and learning.

Conclusion

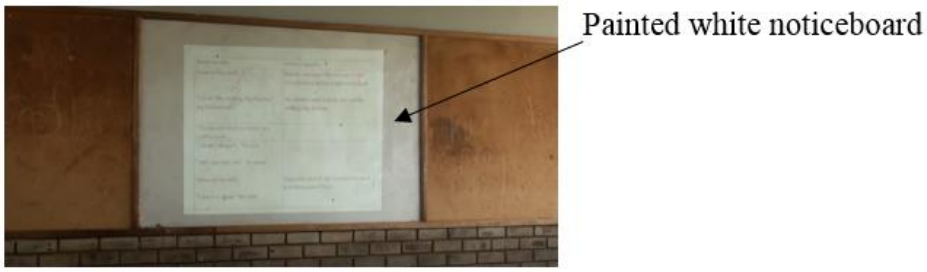
Based on Sizakele's emphasis on what seems to be the main benefit of his use for ICTs, there is a sense that he uses the transmission teaching approach when integrating digital technology. Although there is nothing wrong with giving notes to learners, the circumstances or the learning environment under which they are given determine the nature of learning that will take place. Mere 'explanation of notes' could promote surface learning where the key words or principles are presented (Laurillard, 2002) and that is not ideal for language acquisition. Structure should be applied and extended beyond the situation it is learned from. Language learning is related to the way Brown et

al. cited in Laurilard (2002) describes conceptual knowledge. They say, it is similar to a set of tools that should be used in an authentic activity "to build an increasingly rich understanding of the tool itself and how it operates" (Laurillard, 2002:14) so it can be used in different contexts. However, this interpretation of Sizakele's ICT integration approach is based on limited information as other constituents that make up a teaching experience were not indicated by the teacher. It would therefore be difficult to establish the pedagogical value ICTs bring to the teaching experience.

Enacted practice

Sizakele teaches English First Additional Language to a grade 11 class. He uses his own laptop to teach in this classroom where about 40 learners sit in rows facing the notes projected on the following noticeboard painted white at the back of the classroom.

Figure 5.2: Noticeboard painted white



Although the windows do not have blinds, not much light comes in at the back of the classroom this time of the day, and that is probably the reason why the teacher has chosen this set up. When learners come in, they find all ready with the first slide projected. The following picture shows the setup for this lesson:

Figure 5.3: Sizakele's classroom setup



The only teaching resource used to complement the classroom conversation is the digital technology and it is used to display content structure (the chalkboard is on the opposite side of the class).

Lesson Overview

Topic: Direct and Indirect Speech

ICT used: laptop and a projector

Overview of the lesson

This is a lesson on direct and indirect speech. Sizakele uses 8 slides to teach the topic. The slides mainly have examples and brief descriptions of the different ways of using the grammatical structure being taught.

The content on all slides is presented in written text mode with headings of key words in colour. 2 of the 8 slides have tables that are used to make explicit the difference between the two types of speech and the rest of the content on the other slides is bulleted. The last slide has questions to be done by the class in pairs.

The teacher seems to have an urge to cover all the content which entails a wide range of grammatical contexts (verbs, pronouns, adverbs of time and place, punctuation, question words, commands and exclamations) in a 30 minute lesson. He finishes explaining the notes on all the slides in 21 minutes 28 seconds and learners are left with 8 minutes 72 seconds to complete the task. This description has characteristics of a teaching approach where knowledge is transmitted from the teacher to the learner. There seems to be an assumption that since the knowledge has been imparted, they will be able to do the task. And yet this might not be the case particularly if learners have not been given enough opportunity to make explicit their conceptions. Laurillard (2002:71) argues, "a continuing iterative dialogue between teacher and student, which reveals the participants' conceptions, and the variations between them, and these in turn determine the focus for the further dialogue".

Sizakele introduces the topic by asking learners what the difference is between direct and indirect speech. A learner responds by giving examples and the teacher gives the correct response to his question. The teacher then explains why it is important that they (learners) learn the difference between the two. After the introduction the teacher asks learners a question after each explanation to check their understanding. He uses the feedback (answers) from learners to identify misconceptions, extend and adapt his explanations to make clear shallow understandings in the following extract:

> *Teacher: Why do we have to study that (direct and indirect speech) in our daily lives? Is it important?*

Learners: *Yes.*

Teacher: *Is it important?*

Learners: *Yes.*

Teacher: *Why is it important?*

Learners: *So we can be able to speak properly.*

Teacher: *So it is important for our daily communication. Every day we find ourselves repeating what other people have said. Therefore we need to learn direct and indirect speech. For example if I were to send you to the principal now and I say, "Go and tell the principal that I've a visitor in my class." So that is direct speech. So when you get to the principal, you will have to report to the principal what I have said, then you will be telling him what I have said. Therefor you are using indirect speech. When I talk to you its direct speech okay?*

Learners: *Yes*

Teacher: *When you go to the principal that is indirect speech.*

This lesson is presented at the discursive phase in Laurillard's (2002) Conversational Framework although the adjustment of descriptions is only at the level of the teacher. Learners mainly give additional examples verbally and their feedback is used by the teacher in the re-descriptions.

Table 5.6: Interpretation of Sizakele's enacted practice

Media forms	Affordances		Evidence		What pedagogical value does it add?	
Narrative	Non-linear *Display on the board for access to all* - linear	/	Multimodality *Written text and tables*	/	Apprehending structure/ connections *The display provides principles from which explanations and examples are developed from. Learners struggled to apprehend structure – teaching method*	/ x
Interactive	Immediacy *Instant teaching material accessibility.*	/	Immediate feedback *Question and answer used*	x	Misconceptions amended. *Learner responses were revealed, and that promoted further teacher elaboration and extended understandings*	x
Communicative	Collaboration *Display of task*	/	Discussion: Class/ group *Response to task*	x	Re-descriptions of conceptions *Learners had 1 minute to work in pairs as they had to copy questions first*	x
Adaptive	Diversity *None*	x	Reproduction: model/ role play *None*	x	Concretising theory: practice *None*	x
Productive	Articulation None	x	Micro worlds None	x	Knowledge construction None	x

Narrative

The affordance seems to provide the learning environment with a fixed frame from which elements of the grammatical structure can be viewed from, as the teacher introduces and explains the concepts. This pattern is followed as the teacher goes through slides and for that reason, usage is linear. The aspect to be focused on is displayed as a heading and below it is a table showing how the element differs from the other part of speech. The following upper section of a slide is used by the teacher in his conversation to explain how an introductory verb changes from direct to indirect speech.

Extract 5.1: Direct and Indirect speech slide

Direct Speech	Indirect Speech
Tense of the verb "I don't like making big choices," my brother said	Moves one step into the past if the introductory verb is a past tense verb My brother said that he did not like making big choices.
"I have a decision to make" my brother says	

Because the content on the slides is too brief for each concept, learners seem to struggle to understand the concepts - based on their responses. For instance, from the 7 questions asked by the teacher during the lesson presentation, learners only gave 2 correct answers. Laurillard (2002) warns that structure is complex and that is caused by the fact that it is usually not overt. The description of the "Tense of the verb" and the example provided on the above slide (repeated below) for instance does not help to show how it is constructed. The example that shows how representation of structure does not provide learners with enough information to make sense of it follows.

Description:

Moves one step into the past if the introductory verb is a past tense verb

Example:

My brother said that he did not like making big choices.

The key word, 'that' is not highlighted to show how important it is in the sentence to be converted. This is only brought up when the teacher gets feedback through verbal interaction. In such a case, much as the display gives access to all learners, making it easy to work on the same issue as they interact, the use of the ICT seems to constrain pedagogical effectiveness. Practice on each aspect

before a comprehensive activity could help give learners space to acquire knowledge and skills on representations in the new language (Laurillard, 2002).

Multimodality is at the presentation of text that varies, making it easy for learners to follow the structure as they make comparisons and take note of key elements on each slide. However, deeper understandings of the concepts depend on how they are interpreted and for a language, space to practise it is necessary, otherwise it becomes difficult to apprehend structure.

Interactive

It is the interaction between the teacher and learners that seems to enhance the explanations and not the digital technology. After presenting an aspect on the slide, the teacher explains and asks learners to give their own examples. It is then that learner misconceptions emerge and the teacher, with the class correct these, but he gives further explanations that enrich their understandings. The extract that follows demonstrates how this interaction guided by the teacher through the speech medium attempts to supplement his explanations.

After reading the second column with the rule and the first example, the teacher asks learners to change the sentence in the last row to indirect speech.

Teacher: Consider the tense.

Learner 1: My brother said he had a decision to make.

Teacher: We are talking about raw number 2 there. "My brother says is the present tense. When you say 'had', it's past perfect, okay. Who can assist him? Themba (Calls the name of a learner)

Learner 2: My brother says he have a decision to make.

Teacher: My brother says he have a decision to make? Is that correct?

Learners: No

Teacher: Ya. (Points at another learner)

Learner 3: My brother says that he has a decision to make.

Teacher: That's correct, okay. Give her a round of applause.

Learners: (Clapping)

Teacher: Okay, this is another rule (additional information). If the introductory verb is in present tense, the next part of statement is in present tense. Says – Says (Pointing at the slide) …

Besides being available to the whole class, the content on the slide is used as the starting point and referred to in the explanation and interaction between learners and the teacher. The whole class is able to visibly work together in the construction of understandings about the concept structures and their differences.

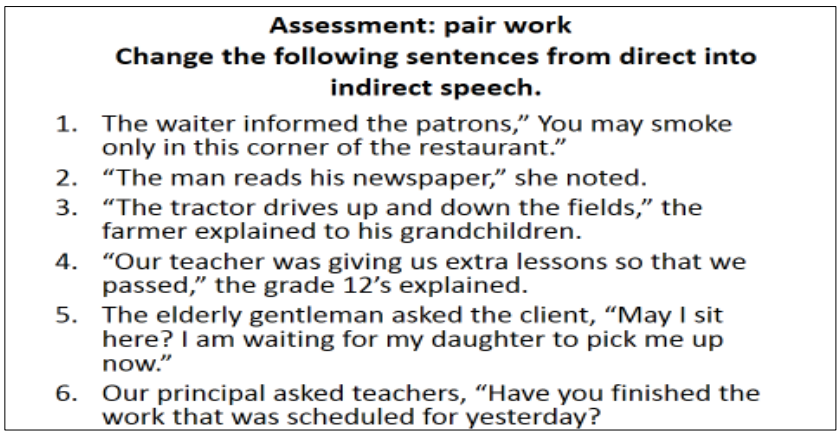
Immediacy is at technology level as the teacher is able to get to the slides in a moment. This affordance seems to work to the learners' disadvantage as a lot seems to be covered in a short time and this is not ideal for learning this subject. Feedback from learners comes when required to give examples and it is at this moment that the teacher identifies misconceptions and amends them.

Communication

Because of the teacher's urge to go through all the slides, there is not much time left to work on the task to be done in pairs. The following events demonstrate the consequences of this ICT dominance in this lesson that made the engagement of this media form not so successful. With less than 5 minutes to work:

- Learners begin by copying questions and when the teacher realises there is not enough time to do the work, he instructs them to stop copying and answer the questions instead, a minute before the lesson period ends.
- The bell goes just when they start working in pairs.
- The activity given on the last slide below demands that learners work from higher cognitive levels. They are supposed to integrate all the concepts learned during this lesson and this might be challenging for second language learners who are still struggling to grasp the main structure/s of the concepts.

Extract 5.2: Class activity



Assessment: pair work

Change the following sentences from direct into indirect speech.

1. The waiter informed the patrons," You may smoke only in this corner of the restaurant."
2. "The man reads his newspaper," she noted.
3. "The tractor drives up and down the fields," the farmer explained to his grandchildren.
4. "Our teacher was giving us extra lessons so that we passed," the grade 12's explained.
5. The elderly gentleman asked the client, "May I sit here? I am waiting for my daughter to pick me up now."
6. Our principal asked teachers, "Have you finished the work that was scheduled for yesterday?

Making learners work in pairs is a good teaching method, but as long as the fundamental aspects of the concept have not been established through the notes on the slides that are too precise to be applied, the outcome of the learning activity might not be as successful. Since the outcome of this lesson was not part of the study's interest, this conclusion remains at theoretical or prognosis level.

Conclusion

It seems the teaching approach used, particularly in this discursive phase is critical when integrating ICTs if effectiveness in its implementation is to be achieved. While dominance of the conversation is not a problem in creating a productive learning environment, linearity and lack of flexibility in the engagement of digital technology takes away the potential both media has in enhancing learning. The subject nature or how it should be taught is paramount in making decisions about how technology should be integrated if its use will be of significance. Language acquisition for instance demands practice in the aspect being learnt before learners are expected to apply the new structures in various authentic contexts. In a case where structure representation is too precise, ICTs and the interaction seems not to be enough to provide learners with a learning environment where learners can construct their own understandings cognitively.

Analysis of coherence of teacher espoused and enacted practices

Sizakele's beliefs about ICT integration are predominantly related to technical benefits that alleviate his teaching. In other words, he is able to carry out his duties 'efficiently' because of the ICT affordances. This seems to relate to his teaching approach and the misconceptions that he has on what ICT integration entails.

In his espoused practices, he mentions that based on his inevitable movement from class to class, ICTs help him cope as he is able to give and explain teaching notes timely. This benefit is replicated in Sizakele's actual teaching. Timeliness to him seems to be more important than the learning process as covering much content over a short space of time seems to be his teaching goal. The subject learning demands and learner needs are subordinate in both his espoused and enacted practices.

He seems to use ICTs to transmit knowledge (to give notes) in the description of when and how he uses digital technology to teach. In the classroom he is observed displaying and explaining a number of aspects on the broad topic which demands deeper levels of understanding before the comparisons are made. This teaching approach seems to constrain rather than create a learning environment that supports learning of a second language. Learners need practice in the

"interpretation and manipulation of the formal representations found in any academic subject" (Laurillard, 2002:31). This is to be expected, where a language structure being learned is different from the mother tongue, ignoring that fact can cause unnecessary frustrations in acquiring a second language.
The Conversational Framework at discursive level advocates for a sound understanding of the concept which is brought about by the interaction between the learner and the teacher. There needs to be a sense of scaffolding as both use each other's feedback to negotiate the desired level of meaning. This is necessary if the teacher and learner will share the same understandings. Providing learners with the structure and making that the key feature could be a way of promoting a surface approach to learning which has its consequences in terms of the limitation of its usefulness and application.

The emphasis on technical benefits of the ICT seems to make the teacher rely on it at the expense of other more effective resources and teaching methods. Technology use ends up determining the teaching pace, overriding other teaching techniques that might be desirable for what is being learned and flexibility needed in the development of learning. As the conversation progresses, how it develops should depend on whether the level of shared descriptions is achieved. If not, the teacher ought to call on his repertoire of teaching resources to augment his teaching, the conversations and not remain stuck on a technique that seems not to add value to learning.

Relying on presentation media to portray the complexity of structure can cause blockage in learning instead of creating bridges between experiential (their home language structures) and academic (second language structures) knowledge for it to take place. It is clear from Sizakele's reliance on this static nature of digital technology for his teaching that the conversation should take priority and the ICT be used to supplement what is already there so that as Mshini says, technology can then 'do what cannot be done' or expressed adequately with conventional media or teaching techniques. Engagement of multimodal texts or other materials design elements could help expand or extend the structure in a way that will make it easy to understand the key features displayed on a slide for instance.

Feedback should help both the teacher and the learner to re-describe their conceptions of the topic, otherwise there is no evidence that they both have shared understandings. Sizakele uses examples to detect if learners have the same conception as his, but it is only when he receives feedback that he then enriches the concept, making it clearer by justifying and in some cases adding to the principles. Thereafter, there is no way of checking if learners share the same understanding as he immediately

moves to the next point on the slide. That leaves the observer speculating the extent to which learning has taken place especially when there is no activity that confirms it as the interaction in the framework makes that information visible.

This teacher's teaching approach seems to be strongly influenced by his misconception of what he believes ICT integration into teaching is as for him it is only applicable from an online environment. It is probably for that reason that he excludes learners and focuses only on the technical aspect and benefit of his usage. When he gives power to this tool that does not have pedagogical value on its own, effective learning is bound to be compromised. It seems as long as the teaching that is, the conversation is not the dominant factor, ICT use in teaching does not augment but reduces teaching to a shallow experience that fails to achieve its sole 'purpose of making learning possible' (Ramsden, 1992).

Sizakele's enacted practice clearly shows how the 3 media forms are related. The narrative media sets up the foundation that the rest of the learning activities should depend on and yet its establishment depends on the feedback from the interactive and possibly the communicative media. As the teacher and learner get feedback from each other through interaction, the conceptions about the topic are made explicit and are modified to the appropriate descriptions of the world. In the case of a language, the incorporation of the adaptive phase was probably inevitable considering the subject learning demands. Learners would have had an opportunity to apply theory as they practised in authentic tasks that digital technology could have afforded.

Wenger in John and Sutherland (2005:408) argue that,

> for technology to be used effectively in a learning process it must be used effectively in any learning process it must be highly visible as a learning tool but at the same time highly invisible as mediating technology.

It seems therefore, if ICT affordances are used as evidence for learning, the value of the experience is compromised, but if they are integrated into the conversation, in other words into the cognitive development, their use for teaching becomes significant. The pedagogical value of ICTs therefore depends on what specific role the technology is playing in enhancing not just the operational (technical) aspect of teaching, but the actual mediation process.

Overall conclusion

What is emerging in Sizakele's practices is how too much dependence on technology results in a compromised learning experience. It is also important to have accurate beliefs about what ICT

integration into teaching entails to avoid enacted practices that are ill-informed as they tend to be limited to the inaccurate principles and have a potential to becoming disruptive rather than productive in a learning experience. All these weaknesses in the context of providing a learning environment that promotes learning above the mere presentation of the content deem the pedagogical value of ICTs low in both espoused and enacted practices. It is for that reason that this study finds Sizakele's practices consistent.



Takalani

Teacher description

Takalani teaches geography to 43 learners in School B. He has been trained to use the ibox (machine with a combination of a computer and a projector) by the sponsor of this technology. This teacher is the deputy principal and is an ICT champion in the school. He is currently the only one using digital technology in his department and the key user in the entire school.

Espoused practices

Takalani accredits the value of ICT use to its ability to display visuals and giving immediate feedback through automated assessment. Although he occasionally uses the ibox to present lessons he prefers to use it to summarise content after completing a unit in order to get feedback on learner understanding. The software in this ibox can present statistical results of the assessment. What motivates him to adopt this teaching method is his enthusiasm to expose learners to modern technology.

He has been using this technology for the past year and as a result he seems not to be aware of the potential of using ICT affordances to address learner weaknesses. For instance, when asked if he uses ICTs for remedial sessions, he points out that ICTs do not benefit all learners because,

> *Ya, we also have slow learners. There are those who will not understand because of language barriers. There are also learners who are still struggling with eh, the eh, the language of speaking and that is England, actually English in our school.*

Takalani believes ICTs cannot help learners with language barrier as the content is presented in English, a second language. Contrary to this belief, one of the teachers in this study, Mlingani uses the ICT to enhance learner English skills.

When Takalani is asked what he understands ICT pedagogical integration to be, he expresses awareness that it is a new teaching method. He says,

> *I think i-i-it's a shift from the old, eh, certain type of, you know, of teaching. We are actually shifting from the old system to the new system.*

In addition to that, Takalani thinks,

> *It saves time. I think it means a, a learner who learns eh, quicker because they learn things that they actually see, portrayed on the wall or in their computers.*

It is possible therefore that his understanding of this new teaching is associated with the belief that when learners see images of what they are learning, they acquire the knowledge faster. What is surprising though is that when the issue of visuals effectiveness is brought into this conversation, his response is,

> *Eh, it makes them to realise and notice that. Possibly when, when we give them tests it becomes, I don't know. I've given them a test and eh, I noticed that there are those who are still struggling even though the pictures are there and the answers are actually there… I think it's a matter of merely understanding.*

The teacher seems to concede to the idea that in such cases learner ability to remember is not only facilitated by the presentation of visuals. If understanding is the 'matter' then teaching and not the technology that has the responsibility to create a learning environment that promotes successful learning. Learners need to be taught how to interpret visuals in the context of the subject if they will play their role in enhancing learning (Hudgins, 1977 and Laurillard, 2002). The analytical tool that follows analyses the value his use of the ICT affordances seem to have based on what he says.

Table 5.7: Interpretation of Takalani's espoused practices

Media forms	Affordances	Evidence	What pedagogical value does it add?
Narrative	Non-linear *Presentation of video while teaching*	Multimodality *Integration of visuals*	Content structure/ connections *Concretising abstract concepts facilitates understanding*
Interactive	Immediacy *Provide immediate feedback in assessments*	Immediate feedback *Automated assessment – immediate feedback*	Misconceptions amended *Correction of wrong answers in the assessment feedback helps amend misconceptions.*
Communicative	Collaboration *None*	Discussion: class/ group *None*	Re-descriptions of concepts *None*
Adaptive	Diversity *Displaying unfamiliar aspects of the subject*	Reproduction: model/ role play *Visuals (videos) of unfamiliar occurrences*	Concretising theory: practice *The representation of the real makes theory meaningful.*
Productive	Articulation *None*	Micro worlds *None*	Knowledge construction *None*

Narrative

When Takalani uses ICTs to deliver content he integrates visuals into his teaching. He believes when learners see what he is talking about their level of understanding is enhanced. He says,

> *My lesson will be portrayed there on the wall with the details, details that they have never seen before. So if we can't, easier for them to understand it if I'm talking about a volcano that they have never seen before, and I put it on the wall there, and then they can see that this is what I'm talking about with it.*

It seems that Takalani integrates his teaching with these visuals that help his learners grasp abstract descriptions of concepts and they make it easier for them to assimilate new learnings in his subject. It is possible therefore that the presentation of ICTs in a different modal text creates a learning environment that makes learning possible as understanding is 'easier' as Takalani puts it.

Interactive

Takalani's engagement of this media form seems to be when he is summarising his lessons as implied in the following extract:

> *We only use it (ICT) eh, when we want to integrate eh, what we have taught eh, eh, eh, in the past.*

The objective then would be for both learners and the teacher to get immediate feedback through the technology as learners' interaction with the ICT (clickers) during formative assessment as follows:

> *It tells you how many have answered; and how many have answered correctly, and how many did not, did not answer correctly. And I think by doing that I think, eh, the, the, the, kids can really listen and, and, and, and realise their mistakes immediately.*

The software used gives learners instant feedback as they interact with it within the time set by the teacher which can be a matter of seconds. Learners are able to recognise where they have gone right or wrong in their responses to multiple choice questions. While there are debates on the credibility of this type of question where learning from the experience or the value of the results is concerned, what matters is what the learning goal is for using and designing them. Takalani believes learners 'realise their mistakes immediately' and their understanding of concepts is affirmed through that feedback. The problem, especially in the context of the Conversational Framework is that the adaptation or modification of actions or misconceptions is not manifested externally.

When struggling learners are identified by Takalani as the teacher, he says,

> *We will try to organise some, eh, intervention strategy for them. Something like eh, for example, presentation that eh, all those who are, are, are lagging behind at least will be, be given time at least to go and with improving topically and perhaps maybe come and present that to us. Then maybe we can do the, the improvement. We ta..take it from there.*

Taking it from there could mean that intervention strategies are designed to assist learners based on their weakness. This immediacy affordance in such a case would support the teaching process.

Adaptive

Takalani's interest in his integration of ICT into teaching seems to be on its affordance to accelerate learner ability to understand. He believes the ICT adaptive affordance promotes retention as it provides learners with experiences they cannot have in the classroom. These adapted occurrences, he believes leave a mental picture, making it easy for learners to remember. He says about the learner's benefit from this experience,

> *So some of the things that they have never seen, eh, they see it for the first time, and then realise and notice, that this is what we are actually learning about… There also i-i-is the question about that particular topic. They actually, that actually made them to remember what they have seen. There also is the question about that particular topic. They also, eh, you know, remain with the picture.*

This experience provides them with opportunities of adapting theory to reality. When they "realise and notice"; that can be interpreted as them making sense of the concepts and accommodating them. The teacher believes when this happens, learners are able to store the new information in their memory. Takalani also believes by just viewing the representation of the occurrence, for instance, learners would inevitably remember the whole topic. In such a case, the image or scenery acts as a clue. However Dwyer (1967) argues that images on their own, without a teacher or someone to explain do not improve learning. Although it is possible that the teacher could be giving explanations to the pictures, it is also likely that these might not be adequate as he admits,

> *I noticed that there are those who are still struggling even though the pictures are there and the answers are actually there.*

When the clues (pictures) and answers are there and learners still fail, it means they probably missed on the interpretation of the concepts and the interpretation of the images.

Conclusion

The three affordances that Takalani applauds in his use of ICTs are driven by the goal to make learning easy. The way he engages digital technology might seem linear as he says he brings it in after explaining, but as long as the presentation of the technology is accompanied by conversation, non-linearity is achieved. The narrative media in his espoused practice therefore brings pedagogical value as the understanding of the concept structure is established through the use of visuals.

The ability of technology to provide immediate feedback in the interactive media is of benefit to learners as Takalani believes they become aware of their misconceptions and correct them. The problem though is that if this is done externally and learners do not engage in an activity where they actually modify and internalise their misconceptions, they could lose the information before it is stored in their long term memory.

The adaptive process in the Conversational Framework would then assist learners, to adapt their actions at task level. His use of visuals to provide learners with direct link to world of descriptions that they are not familiar with, makes the concepts more concrete. It seems the adaptive media has close links with the narrative as both aim at augmenting understanding of concepts. Perhaps it depends on how the media is used then.

Enacted practice

Takalani teaches Geography in a computer laboratory to grade 11 learners. He uses an ibox with a projector that projects slides onto a whiteboard. Next to it is a laptop that the teacher uses to navigate through the content uploaded onto the ibox. Learners sit facing the screen. Each learner holds a clicker that they use after the revision session to respond to multiple choice questions.

Figure 5.4: Takalani's classroom setup



Lesson observed

Topic: Climatology (Revision)

ICT Used: an ibox – a gadget that incorporates a laptop and a data projector.

Overview of the lesson

The lesson observed is a summary of content covered in the previous 4 weeks and is presented on 3 slides, each covering content on a subtopic. In bullets are the key aspects for each subtopic. As the teacher runs through each slide, each bullet seems to play the role of guiding his conversation on what section to talk about in his presentation.

All that learners do is respond with "Yes" to the teacher's confirmatory statement, "Isn't it?" or complete the last word of an incomplete statement he uttered. This pattern of communication goes on for 11 minutes 5 seconds. The teacher recites the content for the topic covered to prepare them for the multiple choice question (MCQ) test where clickers will be used after the summary. The challenge for this study is how Takalani's method of teaching relates to the Conversational Framework so that the learning activities can be matched and interpreted in the same context. The problem is that what he does makes it difficult to describe the interaction because the assumption seems to be that learning has occurred already during the previous teaching and feedback from learners is given. The selection criteria for participants in this study was not based on the style of teaching to be observed, and for that reason the lesson (revision and the assessment) will be interpreted with the same instrument as the aim is to examine the pedagogical value of ICT use for any teaching style.

This study has positioned this learning experience at the interactive phase, where the teacher and the learner set and aim to achieve the task goal. What makes is problematic is that although this is an external process that is supposed to exhibit how both teacher and learner respond to feedback as they interact, the environment is designed with the notion that both share the same descriptions already. The activity seems to affirm this harmony as learners respond appropriately to the gaps the teacher leaves in his recitation. The activity seems to be located in the dialogue relationship or action 6 (teacher sets goal) and 7 (student's action). The difference is that the teacher in this case is not setting the goal, but narrating the descriptions and the learners' action is dropping the missing phrase or word. According to the framework, this learner response should be followed by action 8 where the teacher checks learner action and gives feedback followed by learner modification of action in action 9.

The assessment task could be considered as student action (action 7) and the feedback (action 8) is given by the ICT and not the teacher in this case. It is assumed that learners then modify their action internally (action 9) as they become aware of the correct descriptions. The question now to be asked is if the narration can be considered as setting the task goal (action 6)? The interpretation of the lesson that follows will consider the whole lesson, both the revision and the assessment as that constituted the lesson and ICTs were used in both activities.

Table_: Interpretation of Takalani's enacted practice

Media forms	Affordances		Evidence		What pedagogical value does it add?	
Narrative	Non-linear *Linear - Display of sub-topics from a unit*	/	Multimodality *Mono-modality - Written text only*	/	Content structure/ connections *Structure narrated by the teacher and learners affirm with their responses.*	x
Interactive	Immediacy *Timely access to feedback and statistical evaluation of class responses to assessment.*	/	Immediate feedback *Automated assessment*	/	Misconceptions amended *Verbal feedback does not give learner misconceptions. Although the teacher has access to the electronic feedback, he does not amend misconceptions.*	x
Communicative	Collaboration *The display acted as a stimulus for the collaboration led by the teacher*	/	Group work *Class responses in the completion of teacher's sentences*	x	Re-descriptions - misconceptions *None as all were in agreement in the revision narration. There were no re-descriptions from the assessment feedback either.*	x
Adaptive	Diversity *None*	x	Reproduction: model/ role play *None*	x	Concretising theory: practice *None* x	
Productive	Articulation *None*	x	Micro worlds *None*	x	Knowledge construction *None*	x

Narrative

Based on the revision narration, the use of the ICT is linear as it remains stagnant once the bullet is brought up. The bullet is used as a cue for the narration that follows after it. Only written modal text is used in this activity and the other media used is the speech mode which is used in isolation of the bullet on the screen. His assumption seems to be that learners already know the content structure and need to be reminded of the details before they start responding to the gaps he leaves in his narration.

The following extract is an example of what he does in his summary presentation:

The second bullet reads: Composition and structure of the atmosphere.

> *Teacher: We spoke about the composition of the atmosphere. Remember we spoke About the 4 layers. (Learners join him) The troposphere; the stratosphere; the mesosphere and the thermosphere. Good! (The teacher exclaims) All these complement each other because they are equally*

important to us. They protect us from the severity of theeee - (at a high pitch and then together with the learners who respond: sun.

Learners: *Sun*

Teacher: *Some of them protect us from the UV---- (at a high pitch and together with learners who respond) R.*

Learners: *R*

The third bullet reads: The ozone layer

Teacher: *Then we spoke about the ozone layer which is also very important. That the ozone layer protects us from the the the UVR. That we should not suffer from diseases like (at a high pitch. This time learners respond first as he gave them time to.*

Learners: *Cancer*

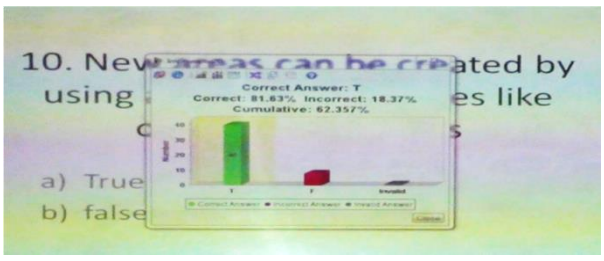
Teacher: *Cancer. Good!*

The assumption that learners have acquired the structure based on this type of response still needs to be proven. However, based on the learning environment created, there is no observed evidence or action taken by the teacher in that regard, it therefore becomes difficult to identify pedagogical value as afforded by the use of the ICT.

Interactive

This media form is evident during assessment as learners interact with the technology (clickers) that provided them with instant feedback. Statistical evaluation in the form of graphs and averages for correct, incorrect and the cumulative result is displayed as follows:

Figure 5.4: Slide with class results



Learners who got correct answers celebrate by clapping hands after each display of results, but as already been pointed out, no intervention is provided for those who got wrong answers more so that individual responses cannot be displayed in the presence of the whole class so they see where they went wrong.

The intervention that Takalani suggests as a follow up on learners with challenges is not necessarily linked to the feedback received from the technology. The other interaction that takes place at conversational level has been described above. The reservations raised above relate to the importance of the role that the teacher in the conversations plays as he integrates ICT affordances. It seems what is compromising the pedagogical value is the inability of the teacher to advance classroom conversations beyond the contribution of digital technology.

Communicative

During the revision narrative, the class and the teacher participated in a dialogic exchange where both parties seemed to work cooperatively in the activity. What seems to be missing is a strong or clear sense of learner ownership of what they are participating in. It is possible that the narrative provided them with all they needed to give the correct answers or that their role was easy enough. For instance, the extract below makes it obvious what to add to complete the sentence:
Slide 3: Moisture in the atmosphere

First bullet: Different forms of water

Teacher: *Yes. Different forms of water. But water comes in 3 different forms. In a, in a state of liquid, in a state of solid and in a state of what?*
Learners: *Gas*
Teacher: *Good*

Next bullet Evaporation, Condensation and Precipitation

Teacher: *Then will also have what we call evaporation, when water changes into ___*
Learners: *Gas*
Teacher: *Condensation, when that gas changes into ___*
Learners: *Cloud*
Teacher: *And precipitation, when the clouds bring us what?*
Learners: *Rain*

One could say learners were actively participating cognitively as they gave correct answers when the teacher provided them with the rest of the pieces for the puzzle, making it obvious what was

missing. The bullet projected on the screen provided an area or topic to be covered and the teacher populated it with information to help learners remember its contents. The big problem with this type of collaboration at conversational level is that it does not make it necessary to re-describe concepts as misconceptions from learners who might not be participating are not exposed in this activity. It then becomes difficult to realise the pedagogical value of ICTs as the conversations initiated by their presence do not make evident the adaptations in the learning activity.

Conclusion

In his espoused practice, Takalani has given the impression that generally visuals help learners remember and yet in his actual teaching (revision) and assessment he does not use them at all. As a result there is a mismatch between what the teacher believes and what he does in terms of pedagogical value brought about by his use of ICTs. However this irregularity is probably caused by the fact that the lesson objective does not need any concretising of concepts as they are already understood. In the espoused practice ICT value is described mainly as an adaptive media and there is none in any of his slides. However, the immediacy in the feedback does match in both practices. In his actual teaching Takalani either prioritises the conversation (narrative) or the technology (clickers). In the narrative, the ICT is insignificant and is not used to help learners to remember through incorporation of images as stated in the espoused practice. On the other hand, when technology is used by learners during the assessment, the conversation is reduced to mere reading of the feedback without addressing learning challenges reflected on the results.

The communicative media is mainly at the level of simply initiating the teacher's narrative and what might look as a cooperative endeavour raises questions on how it can be considered as of pedagogical value as it fails to disclose learner misconceptions even in the revision exercise. This media is not mentioned in the espouse practice but only observed during the narration and so far this seems to be the trend as it also emerges in the first 2 teachers' (Mshini and Sizakele) enacted practices.

Takalani's inability to maximise his utilisation of ICT affordances to bring pedagogical value and to effectively use the strength of conversation to make learning experience explicit has made it difficult to judge the importance of his integration. The biggest challenge is locating his teaching activities to the Conversational Framework that should help make explicit the value in specific learning activities.

Analysis of coherence of teacher espoused and enacted practices

There is a mismatch in the espoused and enacted practices and that seems to be a result of Takalani's teaching approach that does not validate his beliefs about the pedagogical value that his use of ICTs have. It is also possible that the extent to which he engages ICTs contributes to the credibility he gives to its value at the expense of the technology visibly playing its role in enhancing the mediation process.

In his espoused practices, Takalani emphasises the benefit of infusing visuals as concrete representations of new concepts and associates that with accelerated learner understanding and promotion of retention. These beliefs seem to be based on theoretical views that are not grounded from experience with ICTs. For instance when understandings on how they would apply in different learning contexts (implications for learning challenges and improvement) are sought, he seems not to have practical knowledge on how his ICT use can bring pedagogical value. The use of visuals as an adaptive medium is completely absent in his enacted practice.

The immediacy of ICT affordances is evident in both espoused and enacted practices in giving feedback during assessment. The interaction learners have with the technology deems the affordance of pedagogical value. However a close examination of the empirical evidence on how this happens fails to validate the credit given to the technology, because of the withdrawal of classroom conversation which does not rise to take its prominent and significant place in the learning experience. Its place is in providing feedback once learner feedback is received. It seems in this case, the pedagogical value of the ICT use depends to a large extent on the presence of the conversation that should draw from its affordance to enrich learning.

The discussion above is evidence that perceived ICT affordance does not necessarily translate to integration that is of pedagogical value. It is difficult to assign pedagogical value when the learning activity does not externally display the desired value. For instance, as long as the teacher or the learner does not act in a way that shows value has been added, the observer remains wondering if ICT usage was of value to the learning experience. And yet the learning activities in the Conversational Framework make this behaviour evident as the teacher or learner, through conversation or action takes up or follows up on what the affordance has initiated (display) or has revealed (instant feedback).

In the case where the ICT affordance is placed on the background or is used to provide cue for the conversation, which carries on without making reference to its contents thereafter, its use seems to

promote linearity in the delivery of content. Takalani for instance followed the same pattern of delivery mode (speech) without incorporating other modalities that could have helped confirm the value of the ICT. While this study might not understand the effectiveness of the teacher's style of presenting the revision, this class' average pass mark was 80% for the assessment. What was required in the MCQ test was to remember specific items and based on that, perhaps this presentation style was ideal. The class was basically tested on their ability to remember. Engagement at deeper levels of thinking was not necessary for this activity. Although the learning outcome was achieved, this study needed to know the impact of ICT use in improving the level of performance that Takalani had stated in his espoused practice. However, there are other variables that could have contributed to the good performance by learners, like the IQ level of learners, the extent to which they prepared outside this learning experience and of course the teacher's revision session.

Overall conclusion

It seems, when ICT actual use is not driven by well-grounded beliefs that are informed by experience, its effectiveness is compromised. In the case of Takalani, the ICT pedagogical value of his espoused practice is at a high level as he is able to identify the benefits that the affordances bring to the learning process. In his enacted practice, there is evidence that ICTs are engaged in the learning activity, but what pedagogical value it adds cannot be confirmed visibly. It is for that reason that this study finds Takalani's enacted practice low, which is contrary to his espoused practice. His practices are therefore inconsistent.



Mpetha

Teacher description

Mpetha teaches mathematics in School C which is the technical secondary school. He teaches with an ibox and uses a Mobi View to navigate his way through the content on the slides. His engagement of the ICT he uses is above that of other teachers in this study and it appears this is because he holds an undergraduate degree from one of the local universities where he majored in computer science and in mathematics. He uses the computer laboratory to give his learners controlled assessment online. When designing material, Mpetha uses notepad, html code, and java to time the questions. He uses clickers for assessment and ast.net, a programming language to programme content for his lesson delivery. This teacher only started using available ICTs to teach last year (2013) in June and currently relies on the curriculum compliant content uploaded by the sponsor of the ibox as his main content resource. He copies the slides he needs, re-arranges them to suit his learner needs and teaching style or preference and adds such effects as animation, other slides and whatever he feels will improve learner understanding. His enacted practices that follow attempt to make clearer the pedagogical value of how he engages his technical knowledge and skills to enhance his teaching.

Espoused practices

His understanding of ICT integration revolves around empowering learners with skills and knowledge through modelling good online design in his engagement of digital technology in the classroom and online. Since this is a technical school, by virtue of its prerogative, Mpetha believes that learners ought to have these abilities. He argues,

> *Learners need to benefit only because we are in the technology world. If we don't introduce it to the learners, it will be difficult for them to be able to access information on their own.*

Although his justification for exposing learners to ICTs has technical benefits, he makes them use these skills for learning purposes. For instance he says,

> *To develop the subject I sometimes say a learner must come and present. I will be present and I teach the learner and a learner takes a slot in the lesson and I say you are*

teaching these learners…they use the ibox. I present the slides and say you do this then they present to others…Then I sit down and relax, then they connect the projector, they know how to connect, they set it on view, then they also.

In addition to that, he believes that the affordances of the technology that he is using have the following benefits to his teaching:

It promotes me as I present. That's why I end up enjoying using the ibox rather than the textbook. With the textbook I use it to refer for more exercises because the ibox does not have many exercises. Many are in the textbook. It makes it (teaching) easy. It makes it easy.

Mpetha seems to know what and when digital and non-digital technology is of benefit in the context of learning his subject and in the extract above, he demonstrates how he is able to integrate both for effectiveness. This type of ICT integration resonates Dron's (2012:27) view that "educational technologies and their parts must work together, or be made to do so" for effectiveness. This can be interpreted as working in a way that weaknesses in one media are compensated for by another. Mpetha also enlists the following technical benefits that seem to enhance his teaching:

In terms of teaching, I use the ibox because the ibox has everything, the projector and the tool we use to write on the whiteboard. It has a device that we use, a mobi. No need now to say now I'm rubbing and say now I'm writing for the class. I use the ibox in every lesson.

Mpetha uses available technology in all his Mathematics lessons and when asked if the available technical assistant assists him during the presentations, he adds the following information about himself:

I don't need him because I am a technical specialist. I design, if it's a problem with the program I know how to design programs. If it's a challenge with it, I know how to do it. Sometimes these things related to computers, on my side, it's a hobby.

The above extract just shows how techno savvy Mpetha is and this seems to be a bonus in his confidence and freedom to adapt ICTs to enrich his pedagogy. When asked to justify his claim that his ICT use has enhanced learner performance, he says,

I remember last year when I was teaching, I could teach the whole lesson and give examples to learners and find that there is no one who got the answer correct. That was 2010. 2011, it was still the same, but now when I use the ibox. The ibox does not use a

lot of examples. The ibox is coming straight to what is needed. The outcomes that are needed. I didn't have to drive learners to go far to come to where they need to learn. So when I use this, I just celebrate for those who get maybe one wrong because the majority get it right in terms of performance.

Although the meaning of coming straight of the ibox might be ambiguous, it can be interpreted as having content that is relevant and affordances that facilitate accelerated achievement of learning goals. The fact that he claims his learners now perform well could be associated with that he is able to create a learning environment with technology that alleviates learning barriers in his classroom. He says,

The way I am presenting on the slide it also cater for those who are not fast on capturing. The way I design it, it's easy to understand.

It is possible that his materials design could be making the content so concrete that learning becomes possible regardless the complexity of the concepts. The following analysis of Mpetha's beliefs will attempt to demonstrate his descriptions of his espoused practice.

Table 5.9: Interpretation of Mpetha's espoused practice

Media forms	Affordances	Evidence	What pedagogical value does it add?
Narrative	Non-linear *Different affordances integrated*	Multimodality *Use of multimodal texts in content delivery*	Content structure/ connections *Materials design facilitate easy comprehension. Links with other subjects and real life experiences.*
Interactive	Immediacy *Automate assessment and timely processing of results statistics. Easy navigation during lesson presentation.*	Immediate feedback Assessment *feedback.*	Misconceptions amended *Interventions where misconceptions are amended are designed based on evaluation of statistics from automated assessment feedback.*
Communicative	Collaboration *Design of group tasks*	Discussion: class/ group *Group tasks and discussions in the presentations.*	Re-descriptions of concepts *Learners are free to challenge classmate presentations leading to misconceptions being exposed and rectified within the groups and as a class.*
Adaptive	Diversity *Adaptation of materials design to suit teacher and learner needs.*	Reproduction: model/ role play *Animation and other design elements that enrich learning*	Concretising theory: practice *Concretisation of abstract concepts. Relevance of available and adapted virtual materials to real-life experiences to make sense of abstract concepts.*
Production	Articulation *Design and presentation of task solutions.*	Product *Materials designed online with desired effects*	Knowledge construction *Empowerment to solve authentic problems through modelling by teacher.*

Narrative

The teacher seems to believe it is his electronic materials design that learners are able to understand his explanations. For instance he stresses the importance of making the materials relevant to

learners' daily life experiences and believes that gives his content credit over the text books. This approach appears to be influenced by the design of materials by the hardware sponsor.

When describing the materials he says,

> *They want to say learners must be familiar with what they are learning in the environment that they are living in. They must identify Maths things inside that…*

The teacher believes the use of real-life examples in the sponsor materials, in particular has an impact in helping learners understand abstract Mathematics concepts. In his commendation for his ICT use, he states,

> *The ibox is coming straight to what is needed… I didn't have to drive learners to go far to come to where they need to learn.*

This could imply that the modified materials are so succinct that learners find it easy to grasp content structure and connections within concepts in the lesson presentations. Mpetha also gives credit to his teaching approach as he makes learners aware of subject links to help them establish related concepts.

> *The reason why we say there is improvement, it's not only in mathematics. With ICTs, it brings all the learning areas together and when we bring all the learning areas together, we use the maths within those learning areas. There are some of the things that we do in chemistry and some we do in … but those things that we … I can also talk to the teachers and use something they did and say, in physical science you did this and this and this is how you do it, then I tell them in maths it's the same, we change the names, it's the same way. So even when they are writing, they will see it's the same. We integrate with other learning areas and once they understand in maths, they find it easy to understand in other learning areas.*

The teacher uses different modal texts and designs them in such a way that learners are motivated to learn. In appreciation of his materials design, he says,

> *Like in maths now the animation on the slides shows the movement from one point to the other to show what is happening. It's to say when at home we are able to do this and this. They are able to relate it. But I'm not saying for the problem at home they use ICT but this one helps them to see how we can solve the problem at home.*

Some design elements that he says he incorporates seem to make real, abstract ideas in his teaching to a point that learners can relate them to their everyday life experiences. To emphasise the role ICTs play in his teaching, Mpetha says,

The ICT helps with the procedure, because without procedure, you cannot do anything.

The procedure is really the process of establishing structure or that which contributes to solving problems in mathematics.

Interactive

Mpetha points out that the affordance the technology has is able to gain immediate feedback from the automated assessment which he then uses to strategize on how misconceptions can be dealt with. He uses interaction between learners to make amendments at group and class level. When he gets feedback in one of his strategies, he does the following:

> *Those who are struggling, the ibox it automatically marks and give a report back showing this learner is weak on this question number, a challenge on this number. It groups them according to questions. After that my part is to group them and spread them among other learners and say now you are going to present. They have to work and ask their members how you do this…So I make sure those who are not strong are mixed with those who are. Everyone knows that the teacher does not need a group leader. The teacher will get any person from the group to come and present. So everyone has to prepare. (Laughs)*

It is therefore evident that the teacher incorporates collaborative work to deal with misconceptions. The product is finally tested during the lesson when one member from the group (the one identified as weak in the assessment evaluation) comes and presents in class. Misconceptions are amended as learners argue for or against the solutions presented.

Communicative

The teacher seems to believe in the impact of learner collaboration as they help each other figure out solutions to given tasks. Collaboration is not carried out online as Laurillard (2002) describes it, but in groups that meet face-to-face. He says the benefit of using this strategy is that,

> *The group consists of people who are good and so they must teach because when the group is losing, it's not because they did not get the answer correct. It's because they did not present well and because they did not prepare the group members.*

Learners identified as weak are placed together with strong ones in this case. Although collaboration at this level is not online, it is the technology affordance that helps in determining the criteria for setting up the group. Technology is finally used to present the solution to the problem

given. Each group is given a different problem that addresses a specific element of the concept taught and these presentations end up addressing all aspects of the concept and class weaknesses are addressed within and through this learning experience. According to Mpetha, the other benefit of using this strategy is that,

> *They have become free to ask because they are seeing a learner (presenting) so they end up having arguments to say no you can't do this, you can't do this because it's a learner*.

In this case learner understandings are tested and re-defined cognitively as they take into consideration other learners' views.

Adaptive

The teacher's competence in using the ibox enables him to pick what he needs from the ready-made materials and adapt it to his and learners' needs. He acknowledges his ability to manipulate technology which makes it easy for him to draw from other resources and applications that ultimately enrich his teaching. For instance, he says,

> *…the content that is in (in the ibox) it doesn't have an end it goes throughout. Then when I am preparing I set where it must not show so it only shows this content so that I am able to assess learners at the end of the lesson…On the following day I change and select what I need then I cut it and I put the setting.*

Mpetha's competence in materials design enables him to adapt content and any other resource to suit his lesson needs. In response to a question on the benefits of his type of ICT use, he says,

> *And they (learners) are attracted by the way I use it because they say the way I use it is so funny. When they look at something, then is the end of the lesson when they are still looking for something more. So they say the way it's presented is different every day because when we (referring to himself) design the slide, we don't design the same pattern every day. At times we use animation, at times the way we display how it* appears *because they are used to the teaching.*

His ability to vary his lesson presentations seems to attract and sustain learner interest in what he is teaching. Animations are used by the teacher to adapt the learning environment so it is easier for learners to understand theory and apply it in their tasks. An example he gives is,

> *Like in maths now the animation on the slide shows the movement from one point to the other, to show what is happening… but it depends on how it is designed. When we design we think.*

This, he believes helps them perform well in the problems he gives them as he says he celebrates when a learner gets something wrong. This could be an exaggeration used to emphasise the impact of his ICT usage.

Mpetha also commends the way the sponsor's materials are designed as they make it easy for learners to relate to the descriptions about the world (academic knowledge). He draws attention particularly to the examples given that,

> *But when it comes to the technology thing, they use examples that are, like they talk about marks of a learner in the classroom. So some of the examples they are used to and they know them. Like if they are talking about the average, for average if they get the average and show that the average based on the statistics of a group in South Africa, that one is something that they are familiar with. But if we say, the average marks of your test that you have written or your marks for first term – you add and divide with the total of the tasks it becomes easier. And this much based on the technology they are using. They (designers of the materials) want to say learners must be familiar with what they are learning in the environment that they are living in, they must identify maths things inside that.*

What Mpetha is emphasising here is the importance of localising learning materials so learners are able to grasp key features in the concepts as familiar experiences are used. This idea can be related to Laurillard (2002:16) that, "concepts need to be grounded in experience and practice before they can be abstracted. It is common pedagogical practice at all levels of education to start with concrete examples, or illustrative examples of general principles". In other words, the materials design should incorporate design elements that concretise abstract material to facilitate comprehension.

Productive

Mpetha believes his modelling of 'good' practice motivates and empowers learners to be innovative in solving problems. He gives them authentic tasks and when they present to the class, they can employ some of the modelled techniques. In his explanation of how he develops thinking skills in his subject for instance, he says,

> *We bring more new things relating to what is in the textbook. They end up having to say, we can bring our own and start working on our own. They also have this thing of*

saying, it means if for example number 1 was done like this, I can create my own, it will work this way.

This can be interpreted to mean both design features and conceptual knowledge are engage by learners to create their own knowledge.

Conclusion

While Mpetha seems to have technical skills for operating the computer that are beyond what is expected from him as an ordinary mathematics teacher, he is clear with the role that technology plays in order to achieve a particular aspect of teaching. In other words, he knows when technology would be of benefit and when it would not. When asked when he feels ICT is more productive in his teaching he says,

It helps in the introduction. Also it helps on the summary, but not in the middle, it's not best, but the introduction it helps because they bring what they live with from their society into the classroom. Some of the videos that we use in the introduction, they show things that they are living with inside the mathematics.

His beliefs seem to have a strong effect in his decision on how he integrates ICTs into his teaching. In the above extract Mpetha shows how his beliefs about the effectiveness of exposing learners to their daily experiences influence his decisions to use ICTs in particular moments in his lesson.

The teacher's ability to manipulate technology could be the reason why he is able to engage all media forms. The media forms are not always as in the form of objects but in the broader sense of the meaning which includes speech as one of them. The communicative media for instance is not engaged through media as in ICTs but as a teaching method that is initiated by the use of digital technology as an interactive media. Mpetha's descriptions also make explicit the benefits as portrayed in the Conversational Framework. He is able to explain how he applies his pedagogical beliefs in the integration process. What now remains is seeing how Mpetha applies these espoused practices in his actual teaching in the next section.

Enacted practices

Mpetha teaches mathematics to a grade eleven class in this technical secondary school. He uses the ibox with the Mobi View and a laser pointer to teach the observed lesson. The classroom setting is as depicted in the picture below.

Figure 5.5: Mpetha's classroom setup



The whiteboard displays the topic for the lesson on Mpetha's first slide.

Lesson observed

Topic: Cumulative Frequency

ICT used: ibox, mobi Vew and laser pointer

Overview of the lesson

This is an introduction of a section in 'Statistics' and the observed lesson is a continuation of the sub-topic, 'Frequency'. The lesson covers the following: cumulative frequency, lower, median, upper quartile and how these are represented on an S-shape graph. The teacher spends the first 3minutes moving around to check previous homework that was on finding the frequency polygon (a graphical method for understanding the shapes of distributions http://onlinestatbook.com). He then spends 19:50 minutes of the lesson on an ICT integrated teaching and learning of the new concepts and 7:10 minutes is left for learner activity. For their classwork, each group is given a different question from the textbook exercise on the content covered to tackle as a group. Each learner is expected to do the work in their own exercise books, but they are allowed to discuss as a group as they work. What the group could not resolve, they call on the teacher's assistance. The teacher occasionally asks for a learner's book to check on their progress until the 30 minute period ends.

This lesson is operating at the discursive phase and the teacher is introducing a new concept that is part of what has been covered on a broader topic as already indicated above. The following table will show where and how the media forms were engaged in this observed lesson.

Table 5.10: Interpretation of Mpetha's enacted practice

Media forms (Laurillard)	Affordances (Conole & Dyke)		Evidence		What pedagogical value does it add?	
Narrative	Non-linear *Moving from slide to slide, learning platform to the other with conversation*	/	Multimodality *Multimodal texts and media engaged*	/	Content structure/ connections *Non-linearity and engagement of multimodality as the teacher makes explicit the components, the links and processes that make up the total structure of the concept*	/
Interactive	Immediacy *Seamless and instant transition from one representation of concept component to the other*	/	Immediate feedback *The feedback from question and answer is used to dictate direction of the conversation and engagement of ICT affordance*	/	Misconceptions amended. *The teacher uses instant feedback to amend misconceptions before progressing with the development of the concept structure on the slides.*	/
Communicative	Collaboration *Teacher-to-learner: in the development of the discursive phase* *Learner-to-learner: during group activity*	/ x	Group work *Learner–to-learner. Working on activities in their exercise books* *Engagement of screen content by the teacher as he teaches and responds to group queries*	x /	Re-descriptions - misconceptions *In groups, re-descriptions occur as learners work together towards a common understanding or development of solutions* *Teacher's re-descriptions are based on the feedback from learner responses during teaching and enquiry from groups*	x /
Adaptive	Diversity-Direct link with the world *Concretising abstract aspects of concept structure, links and processes*	/	Simulations *Animations and visual representations of concept components. Role play*	/	Practice-theory and practice *Concretising abstract concept components and processes promotes assimilation*	/
Productive	*Articulation Modelling - Engagement of different concept representations to make visible intricate processes that make up the concept structure* *Solutions to group tasks in exercise books*	/ x	Micro worlds *Teacher integrates programmed abstract processes* *Working out task solutions at group level*	/ x	Knowledge construction *Teacher modelling of knowledge construction during teaching enables learner productivity as they tackle given tasks*	/

Narrative

Most of the explanations provided by the teacher in this lesson were not linear methodologically and in the use of teaching and learning resources. The following 14 teacher activity interchanges demonstrates the non-linearity in the 16:46 minutes of the 23:15 minutes of this discursive phase:

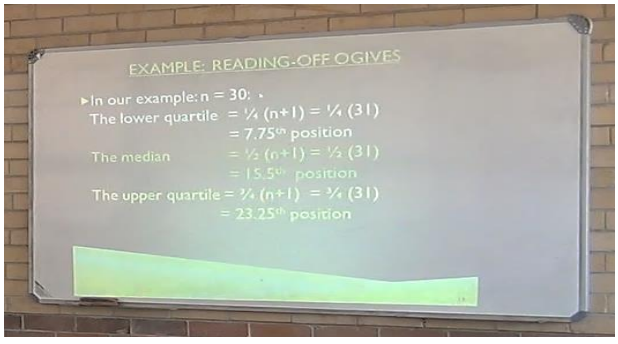
Table 5.11: The 14 teacher activity interchanges

Duration in minutes and seconds	Teaching strategy	Digital technology used with explanations of text
00:40	Question and answer (together with explanations are used throughout the interchange)	Slide with definition
03:15	Role play	
01:08		Graph
00:25	Analogy	
00:37		Graph
00:13	Role play	
00:11		Graph
02:10		Table
00:21		Graph
00:27		Table
00:16		Graph
00:38	Reference to prior knowledge/other subject	
02:05	Object lesson	
00:54		Graph

Mpetha's aim seems to be to develop learner understanding through engagement of all media forms, at times with and at times without ICT use, based on the feedback he gets from learners through question and answer. In order to develop and establish concept understanding and connections, he seems to rely extensively on the content on each slide. This is when the narration of the concept aspects becomes dominant and the mathematical symbols represented on the slides are interpreted during the conversation.

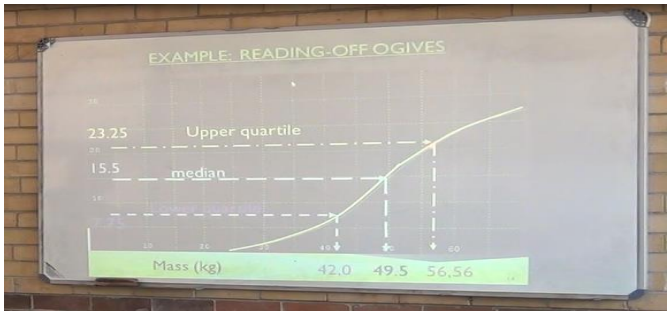
The content and its design is presented in a way that makes it easy for the teacher to explain and for learners to grasp as the data used is the same, making it easy for them to see the relationships, applications of calculations and implications thereof. For instance, the content in the graph and the calculations slide is designed in such a way that the representations used relate to the other slide, making it easy for learners to see the links in the interchanges.

Figure 5.12: Calculations for the lower, median and upper quartiles



After the calculations for the lower, median and the upper quartiles have been done, Mpetha presents the graph below to show how the results are represented in a different form.

Figure 5.13: Lower, median and upper quartiles on a graph



The graph shows how the S shape is eventually produced by the locations of the 3 quartiles on the graph.

As Mpetha introduces an aspect of the topic, he moves to the other slide to show them the implications of the data and information in a different form or representation. Structural clues on the slides seem to play a significant role in helping establish the concept structure and connections between steps and ideas.

What seems to drive the pace and direction of the development of the lesson is the feedback the teacher gets from the learners in each step or activity. If for instance it is positive (learners responding and showing understanding), the teacher moves to the next step, but if they display some misunderstanding, he tends to move away from ICT engagement and solicit the use of other teaching strategies that connects learners to their everyday experiences in and outside the classroom. Once learners grasp the principle he is trying to explain, Mpetha then moves to the next step in the development of the concept that is made available on a particular slide. Laurillard (2002:45) argues that what makes apprehending structure difficult is that "it is rarely explicit" as various symbols that are used need to be interpreted in the discourse for the teacher and learner to share the same meaning. This teacher seems to be aware of this aspect in his presentation of the content as he draws from his repertoire of teaching methods and strategies to help learners follow the development of the concept structure, processes and connections. In addition, the ICT seems to concretise these 3 elements of the concept.

Interactive

In the Conversational Framework, this media form is critical in giving feedback that the teacher uses to identify misconceptions. Mpetha is extensively engaging this media form both at technical and at teaching and learning level. Interactivity at technical level (teacher-to-computer) seems to play a big role in establishing the structure, processes and connections and getting feedback which

seems to determine the pacing and shape of the conversation. The ability of the teacher to move from one idea presented on one slide to the other seems to benefit his teaching as it enriches his explanation significantly as he integrates visual forms of what he is describing. The following description demonstrates what he does:

Activity 1: Question and answer.

Teacher: What shape is a cumulative frequency?

Learner 1: S shape

Teacher: You are not sure (smiling)

Learner: I can see it (pointing at the graph on the screen)

Teacher: The other name for cumulative frequency which is?

Learner 2: Curve

Teacher: It's a curve, then it's also a what? (looking at the same learner as he waits for her response)

Learner 2: (smiles but does not give the answer)

Teacher: Then in terms of this one which is a cumulative frequency you need to reflect what? The whole frequency through the total.

At this stage, the teacher realises that learners have shallow understandings of the concept and he leaves this interaction and engages them in a role play where he allocates them to groups with members who have the same mark for a test. As he does so, he keeps asking them questions to check if they follow the reasoning behind the roles he gives them. For instance, he goes:

Teacher: If these people here they've got 3 scripts. (Moves towards next group) The people who this slide have 6 scripts, the people this other side they've got 2 scripts, (last group), here it's 2 scripts, how many scripts will you have in total?

Learners: (give different answers)

Teacher: How did you get that? (their different answers)

Learner: (counts loudly)

Teacher: When you count the total number of scripts, you say, 3 + 6 + 2 + 2 ne?

Learners: Yes

Teacher: to get it

Learners: Yes

Teacher: So the scripts that are here, we are saying it's less than 10…(with hands pointing at the first group)

This time the teacher continues with the next phase in his illustration (role play) after realising learners are with him.

Teacher: (moves to the 2nd group) The scripts that are here they are less than 20. How many scripts will they have? (referring to the 2nd group).

Learners: Sir, Hah!

Teacher: The scripts here (1st group) they are 3, the scripts here they are 6, the total will be how much?

Learners: 9, 9, 9

Teacher: If I say how many people got less than 20 that includes those who got less than 10. Therefore the answer is 3 + 6 = 9. You say 9?

Learners: Yes

Teacher: Why are you saying 9? It's because you combined this ad that one (moves from one group to the next and pointing with his hands. That is a cumulative, that is why it will be 9.

Learners: Ahm

Teacher: Those that are less than 30 will be how much?

Learners: 11

Teacher: Yes, it's 11…

When feedback shows they have understood what cumulative entails, the teacher proceeds with the graph on the slide which he explains based on the understanding acquired. It is evident from the extract above that the feedback that the teacher receives helps him decide whether to carry on with the slide or to move off to descriptions related to learner experiences.

This interactivity is also used as a tool for walking with the learners – to make sure they are with him as the concept is developed. Whenever their responses display uncertainty, the teacher either engages a different path to the destination with them or refers to another slide that demonstrates what he is trying to get at. Once the destination or the learning goal is attained, learners are given a task to work on in groups.

Communicative

The collaboration that seems to be happening in the development of the concept at class level is dominated by the teacher as the mediator and yet the contribution of learners seems to determine the direction of the course. The media is only used by the teacher and is integrated into the conversations that are constructed in such a way that learners are actively involved in the activity. That is demonstrated by their responses whenever the teacher asks a question to check if they are

with him. For instance when he wants to bring learners' attention to the gradient in the following extract he says,

Teacher: So what happens in terms of like a person is driving a car. The speed of that person is 30 km/hr. Another person is driving 100 km/hr. (Pause) Who is faster?

Learners: 100

Teacher: 100 is fast?

Learners: Yes

Teacher: Who moves a longer distance in a short time?

Learners: 30

Teacher: The one for 30? The one for 30 will move a short distance?

Learners: (class argues – some say longer, some say shorter)

Teacher: (he watches them as they argue and repeats). The one for 30 will move a short distance?(waits)

Learner 1: No sir, it's a short distance in a long time sir.

Learners: (the argument continues)

Learner 2: 100 km will cover more space in an hour. (repeats)

Learner 3: Oh, yes

Learners: Yes sir (They all agree now as there is silence after their response)

Teacher: And the one travelling at 30 km will cover?

Learners: It will cover a shorter space in an hour.

Teacher: (Changes to the slide with the graph as he proceeds with the lesson)

This form of communication seems to relate to Laurillard's (2002:159) view that "Teaching has to be interactive and communicative to overcome misconceptions…". In this case, the teacher gives learners an opportunity to think and reflect on the feedback they give. As learners argue, they eventually agree on what Learner 2 presents. The teacher checks if learners' re-descriptions are the same and accurate by asking about the distance covered by the person travelling at 30 km/hr. This is collaboration in the construction of a concept understanding. Although digital media is not used here, the conversation prepares the class for the next explanation on the gradient presented on the graph slide. This example demonstrates how the conversation is significant in learner understanding of the concept structure.

At learner-to-learner level, learners work in groups in their individual exercise books. They do not use digital technology at all. The teacher is the only one who uses it once when explaining a concept after an enquiry from one of the groups. Each group is required to work on a different task whose solution and process they will present in the next period. Learners in their groups are allowed to talk and discuss as they figure out the calculations for their given task.

Adaptive

This media form tends to appear in all narrative aspects. The teacher's aim seems to be to help learners experience the concepts they are learning, both at conversational and technical level. After identifying a misconception or uncertainty he tries to bring home the idea by applying the principle in question to their classroom or everyday lives. For instance, in his attempt to emphasise the importance of the 'bridge' on the graph, he says,

Teacher: *It's like when you want to move from one point to another point. In between there is a river (shows the presence of a river in front of him with his hands), We need a bridge to what?*

Learners: *To cross*

Teacher: *To cross. Even if you want to cross the railway line, there is a robot and a bridge to what, to cross. You don't just jump it. You must go to the bridge and on that bridge then you cross over (demonstrates over with his hands. Learners smile). So also we are saying the intervals that (now facing the screen and with a pointer, points at the intervals on the x-axis). It's the same that is units, but here at the beginning, we have a bridge from '0' (points at the bridge). We jump some of the values. That is why we put this bridge here to indicate…*

The slides are also designed in such a way that learners can visually see the links or the structure. For example, the movement of broken lines on Figure 5.13 (graph with broken lines) above to show how the results of the calculations of the quartiles produce the S shape. Learners actually saw the broken lines moving horizontally from the quartile on the y-axis, touching the S shape and dropping vertically to the point on the x-axis. With this experience, learners could see the practicality of the process and its effect on the graph.

Productive

Knowledge construction is the pedagogic value for this media form. Mpetha's modelling of the construction process substantiates the assertion by Brown et al. in Laurillard (2002:14) that

conceptual knowledge should be considered "as in some ways similar to a set of tools". By concretising abstract aspects of the cumulative frequency, this teacher is able to provide learners with tools they can use to articulate their ways of tackling the tasks they were given in groups for example. The following extract shows how tools provided by the teacher made it possible for learners to reach the lesson outcome in the last 2 minutes of the discursive phase:

Teacher: We said we are working with these values. The total number of this is what?

Learner: 30

Teacher: It is 30. So on these values that are 30, we need to divide this 30 into quarters (showing his 4 fingers). To divide into quarters, this is what we are working with.(changes slide to the one with calculations. The 1st bullet shows the calculation for the lower quartile: ¼ (n + 1) = ¼ (31) = 7.75th position…

The tools in this case consist of the links and a clear demonstration of the process that needs to be followed to obtain the position on the graph. After explaining and calculating the other quartiles, the teacher uses broken animated lines to show the positions on the graph as explained in the adaption media. It is this visibility that Laurillard (2002:16) says "It is common pedagogical practice at all levels of education to start with concrete examples, or provide illustrative examples of general principles, but the way the teacher conducts this process is crucial for its success" as already been mentioned above. Although this study did not investigate to what extent the principles taught had an influence on the learners' ability to articulate themselves in their understanding of the concept in the given task, it is in the teacher's effort to make explicit the process as described in all the media forms covered above that this study is inclined to consider Mpetha's use of ICT to promote learner knowledge construction as a pedagogical value.

When learners work in groups they use their exercise books as productive media. The Conversational Framework emphasises learner action and "articulation of their conceptions, hence the need for educational media that enables students to produce their own contributions via paper, disc, cassette or network", (Laurillard, 2002:161). Based on the deliberations above, this seems to have been achieved both at class and at group level. At class level, the teacher works with learners to draw from concepts in other subjects, concepts covered in mathematics and those in the present lesson to develop new understandings. At group level, they are supposed to work on a problem together and present the solution to the class in the next lesson.

Conclusion

Mpetha's lesson development is mainly dependent on the feedback he receives from learners and that could be the reason why his actions seem to be compatible with all Laurillard's (2002) media forms as they are based on a framework that upholds a learning environment that supports interaction during the learning process. His usage of ICTs at any of the media forms seems to have pedagogical value and this is grounded in his ability to manipulate technology, design effective learning materials and his classroom conversation.

Analysis of coherence of teacher espoused and enacted practices

Data from Mpetha's enacted practice does not only cohere with the espoused practice but complements and expands on it. In some cases it adds other perspectives that were not revealed in the teacher's response to the interview. In this analysis, a general outlook of the relationship of this teacher's practices is provided before each media form is discussed as evidence of the coherence.

What emerges from this teacher is that besides having advanced computer skills, his teaching competence appears to have a stronger influence on his ICT affordance perceptions and engagement. When the teacher talks about the ICT technical benefits for instance, he explains how the affordance is of value to learning and teaching. In his description of the ibox, he explains how its compactness eases his teaching as he is able to source content, adapt and present it to his learners. In his teaching his navigation from one media and text form to the other makes his use of technology as Wenger in John and Sutherland (2005:408) states, "highly visible as a learning tool but at the same time highly invisible as a mediating tool". The focus in this case seems to be the conversation and its development which is enhanced by the seamless infusion of a concrete aspect or process from the ICT, making the teacher's descriptions easy to understand.

The seamlessness of the integration appears to be informed by the teacher's awareness of when ICT is useful and when it is not. In his response to the interview, Mpetha makes clear how ICTs are useful by saying,

> *It helps in the introduction. Also it helps on the summary, but in the middle it's not best. But the introduction it helps because they bring what they live with from their society into the classroom… In the middle it's a lot of content, a lot of exercises and learner activities.*

Although this is at a broader level, in the actual lesson, Mpetha is able to effectively insert digital technology at the right place where it is able to play its role significantly without making it the focus of attention.

Mpetha is also able to determine what makes ICT use productive. In the interview he points out the following 3 aspects as key: materials design, localising or linking academic knowledge with every day experiences and making visible the process. His observed lesson demonstrates all the 3 and yet while these elements help to get the message across, what seemes to reveal their effectiveness is not their inherence in the digital technology but the way the conversations create a learning environment that helps learners experience what they were learning. Laurillard (2002:24) argues that "Whereas natural environments afford learning of percepts through situated cognition, teaching must create artificial environments that afford the learning of 'precepts', i.e. descriptions of the world". The three characteristics in the materials designed by Mpetha contribute to the creation of this simulated environment in his actual teaching.

When describing how he engages ICTs as narrative media, Mpetha applauds above all the effectiveness of his materials design and how it helps learners with learning challenges understand and how it sustains learner motivation to learn. Mpetha strongly believes the ICT affordances contribute to making vivid the 'procedure' of problem solving in mathematics. Although the conversation dominates in this discursive phase, his slides seem to contain the key aspects of the structure and to make explicit the procedure. Mpetha uses animation to introduce layer after layer and instant navigation to demonstrate the links in the process of using different representations to analyse and present data. It is possible that what sustains learner attention is his non-linearity that he engages extensively during his teaching. His design of materials is such that he is able to give his learners an experience of what the abstract concepts mean. Mpetha does not only focus on the process of the concept development, he also interprets the symbols that he uses in each stage and at times (like in the case of the bridge on the graph) uses analogies to help them relate to the symbol. Although the narrative media form seems to be isolated in the espoused practice, his enacted practice integrates all of them in this observed discursive learning activity.

Mpetha's espoused practice reveals that he engages the interactive media during assessment when learners use clickers to respond and statistics of the results are produced by the software. He also reports that he uses this electronic feedback to design collaborative intervention strategies. The observed lesson does not incorporate the use of clickers for assessment but is focused on the discursive phase as already been stated above. Feedback is received during the conversation and this

time it is not based on covered content but is used to check if learners have understood the teacher's description or are ready for the next step in the concept development. This feedback is different in the sense that it is given face-to-face and yet it serves to identify misconceptions that are amended instantly in preparation for the next chunk to be introduced. This seemingly hierarchical progression in the concept development is scaffolding. It seems once learner understanding is established, the teacher moves to the next zonal proximal development (ZPD) and the feedback is confirming or disconfirming the actual level of development. Although the immediacy of interactivity is digital and non-digital (in both espoused and enacted practices), it seems to play the same role of determining learning challenges which are rectified instantly in the case of face-to-face and later in the case of automated assessment.

In both enacted and espoused practices, Mpetha engages the communication media form in the sense that collaboration is used. He believes in the learning benefits from group work in solving problems and values this activity especially as an intervention strategy after automated assessment results. The teacher applies this approach even when teaching. He allows learners to figure out the desired descriptions as a class. He believes when they work together they are freer to challenge and rectify misconceptions amongst each other. This is confirmed during the time in his teaching when he allows them to argue until they all agree on a view. When they reach shared understandings the teacher is able to proceed with his narration.

Mpetha believes in modifying materials and designing them in a way that will make understanding possible. It is for that reason perhaps that the teacher incorporates animation and multimodalities to help concretise abstract aspects of the concepts. In trying to help learners experience what they are learning, the teacher believes in using every day knowledge or experiences to make subject knowledge relevant. In his observed lesson he uses analogies, role play and examples from learner every day experiences. It is through this strategy that the teacher is probably able to help learners make sense of the theory by making it practical.

Mpetha emphasises the importance of him modelling knowledge construction through the use of ICT as he believes that empowers learners to cope with life after school. During their presentation of tasks, he allows them to use the ibox as a productive media. Although the presentation is done by one learner, the design and development of the production is a group effort. In his teaching, Mpetha models knowledge construction by exposing them to production tools in the form of knowledge and technical skills to develop solutions to problems related to cumulative frequency. He demonstrates how different representations are developed and how they link in his narrative. That helps learners

to discover the processes, links and the whole structure of the concept. In his account, Mpetha points out that his learners generally use exercise books as a productive media and this is witnessed in his teaching. Learners work in groups but writing is done individually in their exercise books. There is coherence in the teacher's espoused and enacted practice in his engagement of this media form in the digital and non-digital form.

What has been observed in this particular analysis is that while Laurillard's (2002) categorisation of media forms is mainly based on benefits from digital media, this teacher demonstrates how to gain the same pedagogical effect through the integration of non-digital media. The other observation is that the media forms seem to supplement each other. This time media incorporates both digital and non-digital. That relates to what Laurillard (2002:173) attests to, when she says her analysis of media is not "fine-grained enough to differentiate all the contrasts possible. It would become unwieldy if it attempted to, but it does show how each type of medium needs further support, and which other media might provide". In this case, the 5 media affordances seamlessly work together and this seems to be driven by the teacher's effort to reach all learners. As the teacher narrates the concept through multimodality and non-linearity, he relies on immediacy in the interactivity for feedback which determines the nature of his descriptions and if learners are ready to engage with the next step in his concept development. Collaboration is used during the discursive phase for instance in order to prepare for the next step by establishing readiness. The adaptive media empowers the narrative as the teacher helps learners adapt material so they can experience it. The productive form is modelled by the teacher as a way of empowering learners with knowledge and skills necessary to tackle given tasks. Laurillard's view is that "In combination, however, each provides the facility the other lacks, and so produces a multiplicative effect of better coverage of the learning process. As long as all five media forms are included then it is likely that there is complete coverage of the learning activities in the Conversational Framework" (2002: 175). Complete coverage gives learners an enriched learning experience that prepares them for knowledge transfer. This could be the reason why earlier Mpetha testified that since he started using ICTs, his learners' performance has improved.

Overall conclusion

In his espoused practice, Mpetha's responses demonstrate a high level of ICT pedagogical value as he is able to describe how his learners and his teaching benefits from the engagement of each media form. His enacted practice discloses the complexity that is inherent in this process as the teacher draws from different affordances to facilitate learning and the development of concepts. Although the digital technology is used to present structure, the teacher manipulates it in such a way that its

contribution is significant in making vivid complex aspects of knowledge. Hence, this study finds his ICT pedagogical integration of high value. It is for that reason that his espoused and enacted practices are consistent as well.



Mlingani

Teacher description

Mlingani teaches mathematics and is the ICT coordinator in School D. He uses the only school laptop, projector and tablets from the school in his classroom. He mainly plays videos from CDs from the Department of Education (DoE) during his lessons. He says he uses this technology "all the time" in his teaching. The teacher was trained in computer basic skills in his under-graduate degree and is using these operational skills to do his administrative work as well. He has acquired additional skills on his own and through assistance from friends who have studied Information Technology (IT). No one in this school is equipped enough to assist him when faced with challenges in computer operational skills.

Espoused practices

Mlingani says the school he teaches in is located in a poor black community and the language barrier exacerbates learners' struggle to understand mathematical concepts. It is for that reason that he finds his ICT use to be of value as he is able to partner with the technology to orient learners into the subject language and ways of thinking mathematically. His partnership with the technology seems to encompass 1) his conventional teaching and the presentation on the CD and 2) learners watching and working with the presenters in his absence. He explains this teacher-computer relationship in the following extract:

> *I am using the chalkboard concurrently with the ICT for explaining what is projected to ICT, like on the screen. They project the question there. They (presenters on CD) do it on their own, we do it together. We observe how the projection goes, like how do they answer. It's not different from the way we (him and his learners) are approaching you see.*

The teacher seems to give the ICT the first opportunity to present and then expounds on the presentation on the chalkboard. It is this collaboration and perhaps reiteration as well that he believes helps to enhance understanding of complex mathematical concepts. When he came to this school in 2012, the pass rate at matriculation had been 30% and it rose to 70 %. Last year (2013) his learners achieved an 81% pass rate, with two failing and the third one given a supplementary exemption. Mlingani accredits this success to his use of ICTs and the following table will try and

identify what he believes is of pedagogical value to his integration. The data used in the interpretation includes both types of ICT usage mentioned by the teacher above.

Table 5.14: Interpretation of Mlingani's espoused practice

Media forms	Affordances	Evidence	What pedagogical value does it add?
Narrative	Non-linear *Conversation and video interchange*	Multimodality *Different presentation media used*	Content structure/ connections *Exposure to mathematical language and extended teacher explanations facilitate understanding of content. Video presents structure*
Interactive	Immediacy *Instant availability of different approaches to solving mathematical problems*	Immediate feedback *Feedback initiated by the differences in the various methods used.*	Misconceptions amended *Interaction evoked by the use of different presentations or approaches reveal misconceptions and the teacher is able to amend them at that moment*
Communicative	Collaboration *Provokes debate as different methods or approaches are engaged*	Discussion: class/ group *Class debates as they come up with different solutions to problems*	Re-descriptions of conceptions *Different language of description facilitates re-descriptions*
Adaptive	Diversity *Provision of different teaching strategies and different approaches to learning concepts. Exposure to LoL and language of the discipline*	Reproduction: model/ role play *None*	Concretising theory: practice *Different approaches and methods facilitate adaptation for different learning styles and different strategies enable learners to select methods they prefer for solving mathematical problems. Extended language explanations*
Productive	Articulation *Exposure to different methods of solving problems*	Product: animation/ model *Not applicable with technology*	Knowledge construction *Learners are empowered to make decisions on what methods to select from and how to go about implementing them by using appropriate language and thinking skills*

Narrative

Mlingani is concerned that his learners' inadequate Language of Learning (LoL) restrains them from acquiring mathematical language and as a result they struggle to understand subject concepts. He explains how the ICT he is using helps his learners,

> *And the language, language purposes, like 'simplify" eh, without using a calculator. Like factorise, some they don't even know what the word factorise mean, you get it. So we show them how factorisation has been done, how we supposed to do factorisation and the language that has been used to just simplify it further as a teacher for learners to understand basically. The language is simplified there. It can be explained, even you as the teacher you can add more.*

It seems while the digital technology provides them with the content structure in simple mathematical language that is not enough as the teacher still has to add more (simplification of this specialised representation). In her discussion on forms of representation, Laurillard (2002: 48) argues that, "The forms of representation adopted by a discipline embody both a way of looking at the world and a description of it from that perspective. Students have to perform an interpretive and integrative process if they are to master the ideas". Because learners are not familiar with the LoL they need to interpret these descriptions, Mlingani in this case supplements the video (ICT) content presentation.

Interactive

Although the teacher's intention to use ICTs is to expose learners to different strategies, exposure to these seems to provoke classroom discussions or conversations that end up exposing learner misconceptions. When asked about the contribution ICTs have to his teaching, he explains,

> *Ya (Yes), particularly for the misconceptions. Other learners are saying this is like this and then I say no, no. Please do it like this because this can be like this to someone else who doesn't know Maths or who is not well versed with mathematics. You see, it might mean a different thing. But when you avoid such things, you see like even the brackets. Other learners might just use the square brackets and this has got a meaning. This is a closed interval.*

It seems as learners make sense of the different methods, they interact with the teacher and with other classmates and that enables Mlingani to get feedback on their understanding of each strategy. The teacher is then able to tighten misunderstandings and rules or principles as well that relate to the subject representations. In the end, the teacher, through this interaction is able to integrate and establish representations from the ICT and his.

Communicative

After exposing learners to different presentations, Mlingani allows his learners to work on mathematical problems and it seems they do so as a class. This strategy results in learners arguing as they work towards a solution. The teacher says,

> *Like the way I explain maybe can be a different from the way I use ICT when a concept is explained like even when like even learners are able to interact on their own you see. Debating you see. Like myself I sit there, they do a particular question, you see. So they debate.*

The pedagogical value in this experience is in that this experience gives learners an opportunity to freely express themselves as they argue for their views by so doing displaying their misconceptions. At the same time they provide each other with re-descriptions. At times the teacher leaves learners with the CD to work on their own as he testifies in the following extract:

> *Like even when I am not around and I've got commitments they are able to learn through watching. Like one learner controls. We (CD) solve this question, they (learners) get the answer. They (learners) see how the answer is being reached. You see just like that. They do that on their own but with a monitoring teacher.*

It is interesting that the teacher is referring to the CD as 'we' and yet he will not be there. It is possible that he has established such a close relationship with the CD that what the presenters do he takes it as a collaborative experience and that they have shared understandings. Through the ICT his learners are always occupied, doing mathematics. It seems during that time learners will be working on a question on a topic that has been covered, hence there will be no need of the teacher to explain concepts. This experience offers them extended practice on the concept covered by so doing helping them adapt to the language of description. The CD will just be there to help them check if their calculations were correct on the same problem. There is provision in the Conversational Framework (Laurillard, 2002) and in the mediation process for learners to support each other in the development of learning.

Adaptive

Mlingani has identified his learner weaknesses that he believes the affordance of the ICT he uses can help give them direct link to world descriptions critical to his teaching subject. He acknowledges that language is a serious barrier to their understanding of mathematics concepts. For that reason, he uses the CD that affords his learners descriptions from experts in the subject. The teacher believes this exposure facilitates understanding of concepts and the ability to operate mathematically. He gives this example:

> *Like 'factorise', some they don't even know what the word factorise mean. You get it? So we show them how factorisation has been done; how we are supposed to do factorisation and the language that has been used on the video, to justify it further as a teacher for the learners to understand basically.*

This teacher is still referring to the pronoun 'we' and this time it is about him and the presentation on the CD. It seems the teacher is using technology to set the standard and once exposed to it, he then explains it at the level of the learners, by so doing, helping them adapt to the desired language and thinking. After the presenter on the CD has explained a concept, to help learners with

understanding the terms used, the teacher explains further. It is possible that this experience gives learners an extended contact with the subject material which is what this teacher refers to as a supplement in the following extract:

> *Like if you are teaching without a supplement, it's like the survival of the fittest. You can organise extra lessons but as long as you don't have supplements to actually also cater for those you know differ in their level of mental capacity and so forth.*

He is therefore able to cater for diversity in his class through using the CD that helps to support, although in this case it appears he is the one that complements the presenters on the video. Mlingani gives an example of how he broadens learner understanding below to cater for his learner diversity.

> *What if I would have done, like there was a question here where I myself I said you can use a expand, you see from grade 12 you expand that cos is like this and sin is like this. But the projector it's when they took out a common factor. To someone the one on expanding might be easy and the one of just taking out the common factor might be easy – different teaching method are being exercised and practised.*

The teacher is also cognisant of the different learning abilities his learners have and to cater for that, he uses digital technology to expose them to different teaching strategies. He believes this approach helps learners master mathematical language and develop the thinking skills desired to solve mathematical problems. The teacher seems to believe that the two partners enable learners to grasp the theories as they are critical in dealing with mathematical challenges.

Productive

ICTs are not used for production purposes here, but the way they are used seems to develop the same thinking capabilities as those advanced by engagement with micro worlds. The teacher demonstrates this by saying,

> *I always encourage them to use these methods as long as you understand. Whenever you don't understand, this is how you should prove yourself to prove that this is correct. You give them more exercises so that they get familiar with the questions… I am empowering them so they have many options and not one way of answering.*

Empowerment is so that they are able to make wise decisions pertaining to what options to take based on the nature of problems they encounter. The learner, hopefully in such a case is able to work independently and to produce solutions to problems in the preferred way.

Conclusion

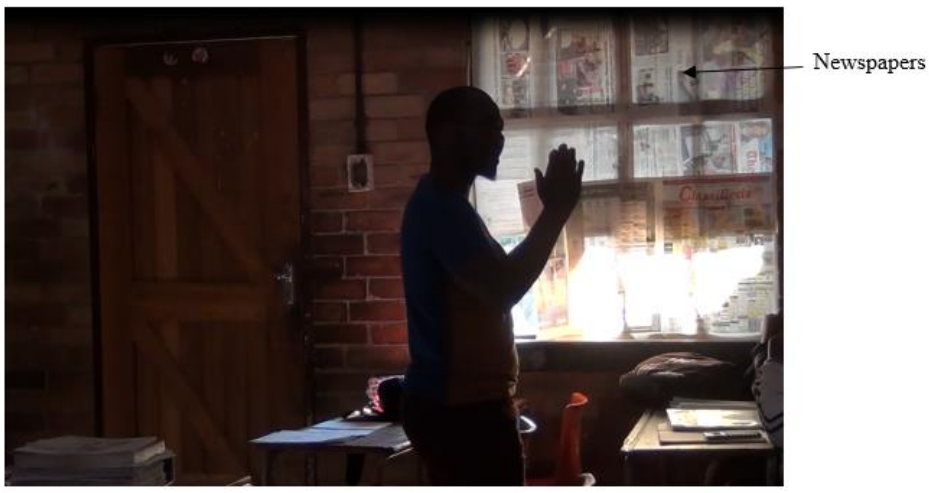
Based on the teacher's descriptions on how he and his learners use ICTs, it seems the role played by the digital technology is significant in the sense that it provides learners with standard descriptions of mathematics concepts he teaches. This phenomenon is similar to Mpetha's use of the slides. What is different from his engagement with Sizakele and Takalani is that he makes an effort to close gaps caused by the use of the ICT. His knowledge of what learners need to acquire mathematical concepts enables him to identify and utilise what the ICT has which he values. He realises how his role is important in mediating between the learners and the presentations to grasp this specialised way of describing the world. He uses the conventional way of teaching to implement this intervention where his role mainly is to make explicit the structure and its representations. That way, both the teacher and the ICT play a significant role in the learning experience. In a way this collaboration between the teacher and the ICT provides learning environments that offer similar descriptions as those of the 5 media forms.

Enacted practices

Mlingani uses a school owned laptop to play a video from a CD he projects on a mobile screen to teach mathematics to a grade 11 class. The teaching venue is a classroom with approximately 40 learners.

Since his classroom does not have electricity connection, he uses a long extension code connected from an administration office that is about10 meters away. He uses newspapers to obstruct light so his learners can clearly see the video from the CD that he uses for the lesson observed.

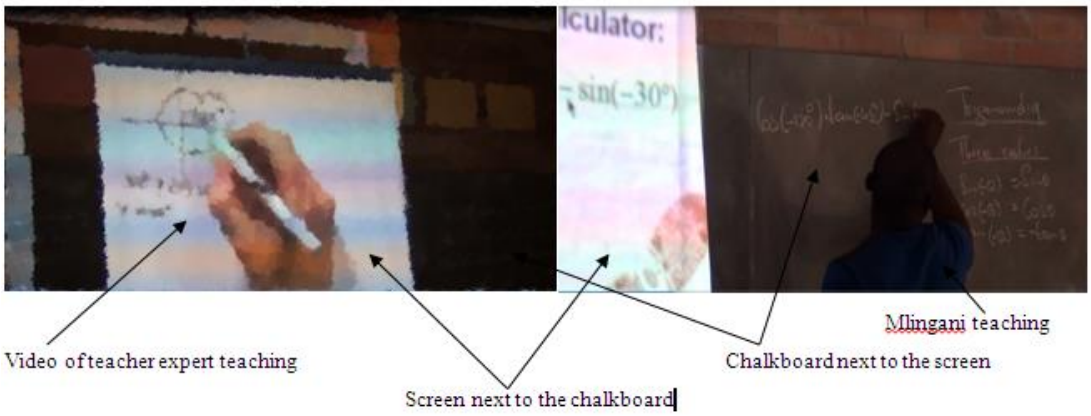
Figure 5.6: Newspapers covering windows



A learner sits in front of the laptop to pause and play the video whenever the teacher commands. The video is on the topic that the teacher is teaching. The video shows a white man presenter (expert) who uses an interactive whiteboard to display, write or illustrate mathematical procedures and a calculator to solve presented problems.

In the observed lesson, Mlingani first explains an aspect of the concept and mainly uses the chalkboard and real life examples to explain and then brings in the video where a presenter (the expert) cover the same aspect. The presenter uses different examples and methods for the same concept.

Figure 5.7: Position of expert on video and Mlingani teaching



The 2 photographs above demonstrate how the two teachers (virtual and live) work closely together.

Lesson observed

Topic: Trigonometry

ICT used: laptop, data projector, CD

Lesson Overview

The teacher teaches this lesson with the presenter on the video from the CD. This time it is Mlingani who starts presenting. In his introduction and development of the presentation he tells a love story that he seems to use to bring life to the mathematical symbols he is teaching. It is about Toto, a young man and Msisiya, a young girl. Toto represents Sin and Tan (Θ) is Msisiya. As the characters in the story evolve, the symbols and the mathematical operations change as in the following case:

Teacher: Now Toto it's about Valentines, yeyi (moves to the board). Toto is a good liar ne (Afrikaans word meaning isn't it)? (Class laughs)

The teacher then writes,

$$Sin(-\Theta) = -Sin\,\Theta$$

Negative incidents in the relationship are represented by a negative mathematical operation (-). The story carries on until numbers representing angles are introduced and following the same process as presented in the story, calculations of an angle are carried out. The video is then played and the purpose is to see how negative angles are explained. The video explains this aspect in detail, mathematically first, repeating the formula presented by the teacher. Thereafter, a similar love story (as that of the teacher) is given and maintained most of the presentation by the presenter and just before he starts working on the example of a problem, the video is stopped. In total this exchange occurs 14 times as represented on the table below:

Table 5.15: Times of teacher – video exchange

Duration in minutes and seconds	Teacher	Video
03:02	1	
03:12		2
06:50	3	
01:09		4
07:32	5	
01:21		6
02:45	7	
01:13		8
01:15	9	
02:11		10
03:44	11	
01:32		12
02:20	13	
01:00		14

This kind of partnership is repeated as the lesson develops. In the hour this lesson lasts, the teacher uses 69.62% of the teaching time (excluding disruptions and pauses) and the video occupies 29.31%. It is evident that Mlingani does not leave teaching to the video but is the master presenter of the lesson. In fact where the video presentation differs from what the teacher has taught, it is stopped and the teacher explains the irregularities and what they mean to avoid confusion. Although this lesson seems to operate at the interactive and the discursive phase the teacher is the guide of the whole process. The following table gives detail of how Mlingani's ICT integration approach is of pedagogical value to his teaching.

Table 5.16: Interpretation of Mlingani's enacted practice

Media forms	Affordances		Evidence		What pedagogical value does it add?	
Narrative	Non-linear *Provision of core explanations of concepts*	/	Multimodality *Video – narration, written text and conversation*	/	Content structure/ connections *Repeats and extensions in the interchange provide space for emphasis, and deeper understanding.*	/
Interactive	Immediacy *Instant support in the delivery of content.*	/	Immediate feedback *Confirmation of accuracy in calculations from the video*	/	Misconceptions amended *During teacher-learner interaction, potential misunderstandings from video presentation rectified instantly – the video is stopped for this purpose*	x
Communicative	Collaboration *Promotes a collaborative teaching and learning environment*	/	Discussion: class/ group *Teacher and learners worked together to solve problems from the video*	/	Re-descriptions of concepts *The teacher plays this role after anticipating misconceptions from the video.*	x
Adaptive	Diversity *Story telling used as a teaching strategy on the video presentation is appropriate for the age group taught*	/	Reproduction: model/ role play *Vocal story telling used on the video– not a simulation*	x	Concretising theory: practice *In the collaboration, the teachers adapt basic subject principles to everyday experiences. Repetition and extension (teacher and video) provides practice and promotes retention*	/
Productive	Articulation *Different methods and extended explanations from the teacher*	x	Product: animation/ model *Nothing done in class as evidence that learners could work on their own*	x	Knowledge construction *Learners were not given an opportunity to construct knowledge individually*	x

Narrative

Although the video and the teacher collaborate in the presentation of the content, the virtual content delivery seems to possess the core structure of the concept taught. That could probably justify why the video only plays 29.31% of the teaching time. The following extract demonstrates how the expert on the video presents the structure.

> *We will be looking at negative angles. Angles greater than 360 and also look at triga-equations where we look at those things. Let's look at these sad doods, they call them negative angles.*
>
> *Well, the angle that you are working with now is called, anti-clockwise movement. It's theta but 30 degrees and if you have 30 degrees that is called anti-clockwise, but if you go this direction you call it anti-clockwise and it creates what we call a negative angle. Okay. So if you go anti-clockwise that's gona be positive. If you go clockwise that's going to be negative. Have a look here (pointing at the image)if we go up it is anti-clockwise and if you go down it is clockwise and negative. Ok. Now this is very very important because we have got some lovely moves from negative angles, check this here. The one thing here says Sin is negative theta = minus Sin theta…*

The teacher then follows up on the presentation by explaining terms, connecting with other conceptual aspects or by applying the knowledge as he solves a problem from the video with learners as in the case below:

> *Teacher: Okay, let's simplify that. What will be the outcome? He points at the formula written previously Cos 120 degrees and what will be the outcome? Please when the ratio is negative, keep it inside the bracket (expression of pleading – facing the class) Otherwise that side is going to disturb you, are we together?*
>
> *Learners: Yes*
>
> *Teacher: So keep it inside the bracket. So minus the tan of 45 degrees. Are we together?*
>
> *Learners: Yes*
>
> *Teacher: So what will be the outcome here?*

In a way the teacher extends learner understanding by demonstrating how new knowledge can be used to solve a mathematical problem. Although the video provides a typical linear presentational media the approach that is used tends to "engage the learner in reflecting and articulating at the discursive level, and in playing some vicarious part in adapting and acting at the experiential level"(Laurillard, 2002: 92). The story telling technique that the teacher introduced the lesson with for instance seems to be a version adopted from the video which is,

> *Think Sin of negative, Sin is like sinning. If you go and cheat on your girlfriend. You go and take another girlfriend up, you are cheating and that is sinning. Your original girlfriend is not going to be happy. Sinning is negative and what is going to happen is that it will have negative consequences for you.*

It ppears by relating abstract concepts to a love story it is hoped that learners relate to the complex representations and descriptions. The classroom conversation and the interchange guided by the teacher seem to promote non-linearity as well.

Interactive

Interaction is between teacher and technology and teacher and learner. The former is collaborative at teaching level (as already been pointed out) and feedback is derived from the technology after the teacher and the class have carried out the calculations. Although the video's calculations seem

shorter, they offer diversity in solving problems and they serve the purpose of confirming the class result as well.

When the video has presented in some cases descriptions are not the same as those learners have and to avoid confusion, the teacher stops it and explains or advises them on how to deal with the challenge. For example,

> *Teacher: Don't be confused by the way they have approached the first one. Here just the cos –x. Do you get it? Something unusual. Do you get it? Rather do it the way you are used to, ngendlela eniyaziyo (he repeats in Xhosa)…*

Thereafter, he explains in the way they are familiar with, in a way offering a different method from that presented on the video.

Communicative

As already been pointed out, there is clear collaboration between the teacher and the expert on the video and the roles of each have been stated under the narrative media. However the learner is brought in during the classroom conversation when the teacher is demonstrating how calculations should be carried out. Although this type of collaboration (one-to-many) is not ideal (Laurillard, 2002), learner responses indicate they are working together with the teacher.

> *Teacher: They can use any sign, alpha, beta, whatever. Or the number, the angle, the number that represents an angle. Do you get it?*
>
> *Learners: Yes*
>
> *Teacher: So it can be what, it can be Sin (-1352) =*
>
> *Teacher: What will be the outcome, applying (Points at the previous writing) the thetas, do you get it?*
>
> *Learners: yes*
>
> *Teacher: What will be the outcome?*
>
> *Learners: -Sin*
>
> *Teacher: What will be the outcome? What will be the theta in this case?*
>
> *Learners: 1352*
>
> *Teacher writes –Sin (1352) = -Sin 1352*
>
> *Teacher: Are we together?*
>
> *Learners: Yes*

Their responses do not really give much in terms of deeper understandings on what they are responding to, more so that the questions need lower cognitive thinking levels. However, in the above extract there is evidence that they are following.

Adaptive

Making abstract ideas real in learners' minds by using story characters seems to be the presenters' way of adapting mathematical representations to every day experiences (love story) to help learners in this age group relate to these new descriptions.

In addition to the affordance the video provides, the teacher repeats and extends descriptions offered on the video as he applies them on the chalkboard. When explaining terms, he does not limit the clarification to definitions, but works it out on the board so learners can learn how to apply the knowledge, thereby allowing them to "build an increasingly rich understanding of the tool itself and how it operates" (Laurillard, 2002:14). The tool in this case is knowledge.

Although Mlingani code switches to Xhosa he does not use the language at the expense of mathematical language. For instance, in his attempt to elaborate on the difference between clockwise and anti-clockwise, he says,

> *It is an integer and it represents a revolution. Do you get it? Why that one is positive is because it is moving anticlockwise. Ixesha musi lihamba kanje, ne (time moves this way, isn't it). (Shows with finger how the clock hands move clockwise) Immediately sithi anti (we move to the opposite), it means opposite. Do you get it?*

The use of Xhosa though assists in the basic understanding of the direction of the clock hands movement and this is established to emphasise the negative and positive angles introduced in the video.

Productive

Production in this case is at the teaching level and can only be for learners if our understanding of learners being empowered is concerned. Learners construct knowledge together with the teacher (directly) as he exposes them to different approaches as a class but not individually.

Conclusion

Mlingani's teaching gives a clear indication of the role his 'partner', the video plays. He clearly carries the heavier load in the lesson presentation although there is a tint of the approach used in the video. Although he seems to rely on the video for the structure of the concept, he makes up for the links, applications and extension of learner understanding through conversation. He makes it his responsibility to interpret and demonstrate how mathematical descriptions can be applied in authentic situations in the context of the subject.

Immediacy of feedback at teacher-learner level is instant, but that of teacher-technology is solicited once it is called for either to present the structure or to repeat the calculation done in class. There are differences observed in the teaching methods and where the teacher feels these would confuse learners, he explains them to give learners a wider range of techniques to choose from when solving mathematical problems.

Analysis of coherence of teacher espoused and enacted practices

Mlingani's pedagogical beliefs about learning his subject, mathematics seem to be of influence to his espoused and enacted practices. It is probably for that reason that there is coherence in both these practices despite the teacher's limited computer skills. Although there is close partnership that he has developed with the digital technology to form an effective collaboration in enhancing learning, he remains the teacher who is adequately performing his responsibility in guiding the classroom conversation.

The teacher's aim in both his practices seems to be to help learners apprehend structure. To him that entails learners being exposed to various problem solving methods and to profound understandings of mathematical language and applying it in authentic scenarios within the subject. All this is accomplished through the partnership between the teacher and the video which is made explicit in Mlingani's enacted practice.

In his espoused practice Mlingani emphasises the importance of acquiring mathematical language in order for learners to understand the concepts and makes clear that he simplifies and explains the terms used in the video. In his actual teaching he makes clear the role of the digital technology, which as in the case of Mpetha is significant in the sense that it asserts the core of what is to be learnt about the concept which is concise and to the point. This presentation of the structure is presented step by step and at the end of each phase an exercise or 2 are offered to the class, giving the teacher and the learners an opportunity to apply the description in a mathematical challenge. The

calculation becomes a platform for a classroom conversation where the structure from the video is reflected on and connections are made with other aspects of the concept so it makes sense in the context of the problem being solved. As this happens, the teacher is aware of the gap created by the ICT particularly in the absence of elaborations and definitions of terms that are critical in the understanding of the aspect described. He identifies these and as he explains them, he shows their function in the process of solving the problem. The problem is solved by the class (teacher and learners) while the video is paused, and a teacher dominated interaction with the learners ensues. More teaching and learning occurs at this moment as the teacher leads the dialogue with learners while writing on the chalkboard. It is at this point that the teacher as stated in the espoused practice that he highlights various ways of dealing with the issues at hand. When the solutions have been found, the video is brought in to give feedback on its version of the solution. The process is often shorter than that of the class and this is when the teacher makes learners aware of the differences, giving them an option to decide which one works for them. Feedback from learners seems to be positive all the time and this is because of the whole-class teaching approach that tends to overlook misconceptions by quiet learners. However the teacher goes into depth in his classroom conversation and his presenting step by step is probably meant to accommodate such learners.

In his attempt to reach all learners, Mlingani, like Mpetha seems to be focusing on the adaptive and interactive media in the context of the narrative. The media is not necessarily the digital but mainly conversational. For instance in his collaboration with the video, the teacher is able to repeat the concept structure and its application, by so doing creating a learning environment that promotes apprehension of concept and usage of the tools needed to solve mathematical problems. Story telling seems to be an approach adopted from the video approach and although it seems to work in establishing structure by relating abstract concepts to real-life experiences, this approach promotes easy transfer of descriptions of the world to descriptions about the world. This characteristic of pedagogical benefit is derived from adaptive media as well.

Although Mlingani believes his ICT use empowers learners to solve mathematical problems, this is reflected in the depth of explanations that he presents in his teaching. His enacted practice does not give fair ground to confirm this belief as chorus learner responses in class might not be credible as a measurement for success in learner productivity. What is worrying though is that learners are not given ample opportunity to individually apply these concepts in the classroom so the teacher can get evidence that they have learnt. However, this study is merely focusing on how the ICT used seems to be giving value to the classroom conversation based on the supposed pedagogical value

Laurillard (2002) suggests on the educational media which in this case takes into consideration non-digital media.

Overall conclusion

Mlingani is able to use basic computer skills to integrate ICTs in a way that is of high value in both his practices. In his espoused practice, this teacher shows he has identified barriers to his learners' learning and therefore uses it to tighten those weaknesses. Unlike Takalani who is also inexperienced with the use of digital technology, Mlingani does not talk about affordances outside the context of his teaching philosophy, but wraps its value within what he believes about teaching of mathematics. In his enacted practices, the teacher works hand-in-hand with the video to enrich his teaching and learning by making it present the basic structure in stages and him interpreting and offering re-descriptions so learners understand. His actual ICT usage also has a high level of pedagogical value and for that reason his espoused and enacted practices are consistent.



Moruti

Teacher description

Moruti is the second geography teacher and he teaches in School E. He uses a laptop and a data projector to teach. Although he started using the digital technology for teaching 5 years ago, Moruti has been using computers for administrative purposes for the past 20 years after being trained by a personal trainer on basic skills.

Espoused Practices

Moruti's long experience working with computers (the longest in this study) seems to have given him much to say about the impact of ICTs in education. This teacher's beliefs on ICT use in the classroom are informed by his experience and not through training. In fact, he started using digital technology years before ICT trainings were offered to teachers. He believes the sessions are designed for beginners, 'kindergarten' as he puts it. They are not meant for advanced users and therefore he has taken it upon himself to advance his skills and knowledge in digital technology. Where teaching with ICTs is concerned, Moruti believes that technology does not automatically make a bad teacher a good one.

> *The more you work with the content the more you understand. That can improve the results. In my case it is experience coupled with ICTs. In other I can't say it's ICTs only. In other words using ICTs as an experienced teacher enhances your performance to an extent, because you see, ICTs cannot close up lack of capacity. It cannot replace lack of teaching skills… So it can only play a limited part up to a point. That's there will always be teachers. Even in heaven I think there will be teachers, seriously, because you can't replace a teacher. You can't.*

He strongly believes a teacher's effectiveness in the use of ICTs for teaching is dependent on his teaching experience. That incorporates all proficiency teacher attributes are critical for effectiveness in the use of ICTs for teaching. For example, he stresses the importance of knowing one's learners in order to adapt learning activity to learner level or needs.

Moruti does not believe ICTs have affective influence on learners. Unlike Mpetha, the 1st mathematics teacher and Bambisana the 3rd geography teacher in this study, he believes digital

technologies cannot change the attitude of a learner who is not motivated to learn. He justifies this assertion on the following grounds:

> *If a learner is not willing to learn, you can have rockets, you can have aeroplanes, you can have anything, you can even have atom bombs. If that learner does not want to learn that learner does not want to learn. So it's attitudes, it's values, it's the support of the parents and where there are no role models these are poor kids. You know to them they describe success in terms of so and so selling drugs, so and so has millions so you know the point that I am getting at. We have the wrong wrong models, people who are getting rich quickly.*

In his understanding, it is the community that influences learner motivation to learn and nothing else. In order to emphasise his point, Moruti says,

> *If a learner wants to learn, even under a tree, that learner will learn. You must have desire; you must see yourself changing; you must see yourself becoming better.*

Although Moruti believes there are benefits for using digital technology, he does not believe their influence can supersede that of human beings. In other words, human initiative is vital if ICT use is to be of value to both the teacher and the learner.

Moruti believes ICTs are part of a conglomerate of teaching tools that a teacher can use to make learning possible. While he believes that teacher attitude, competency and the resources he has at his disposal contribute to effective ICT use, he argues that teacher attributes play a big role in the effective use of digital technologies. He uses the following analogy to make his point:

> *It's like having an expensive Rolls Royce. If it does not have petrol, you are worse than a person who is driving a beetle who has a full tank of petrol. That person can go far. So that it's not enough to have ICTs if you are not skilled to use them, if you don't know how to process them, if you don't know how to get benefit from them.*

Based on Mlingani's response in the extract above, ICT skills and processing them (whatever that means) are trivial. His last point though seems to be a prerequisite for teachers who are using ICTs effectively (with pedagogical value). The perceived affordance and ability to utilise them in the context of the teacher's subject teaching and learning are pertinent.

He strongly believes a teacher's effectiveness in the use of ICTs for teaching is dependent on his teaching experience. All proficiency teacher attributes are critical for effectiveness in the use of ICTs for teaching. For instance he stresses the importance of knowing one's learners in order to adapt learning activity to learner level or needs.

> *In my case it is experience coupled with ICTs. In other words, using ICTs as an experienced teacher enhances your performance to an extent, because you see, ICTs cannot close up lack of capacity. It cannot replace lack of teaching skills.*

This teacher seems to allude to Gibson's (1979) view that technology affordance is inherent in the tool and can only materialise once the user utilises it for a particular purpose. That means, ICTs as tools do not have power to support learning, but the way they are used by the expert to enhance practice can bring value to the performance. In order to explain the impact of ICTs in relation to the teacher and learners, the teacher says,

> *It's like a car. If you are a good driver, there is a difference between a skilled driver and one who is not. There is a difference between a new driver and an experienced driver. The driver in this case being the teacher, and the passengers are the students. The mechanical stuff are the ICTs, the methods, the learning content.*

This summarises this teacher's beliefs in his use of ICTs and the pedagogical value he assigns to them. For him, the key point is that it is the teaching experience, the teacher's decision making on the utilisation of computers, his perceptions on the affordances, and proficiency in using them that bring value to ICT pedagogical integration. The following analytic tool will now be used to identify pedagogical value in Moruti's espoused practice.

Table 5.17: Interpretation of Moruti's espoused practice

Media forms	Affordances	Evidence	What pedagogical value does it add?
Narrative	Non-linear *Display content structure and process in presentations*	Multimodality *Use of visuals (video, illustrations) and text in the explanations*	Content structure/ connections *Breaking down of complex aspects in the content for easy understanding and illustrating links between and within concepts.*
Interactive	Immediacy *Presentation of more content in a short space of time*	Immediate feedback *At technical level as ICT responds to input/ instruction. Question and answer*	Misconceptions amended *Transmission of much content - learner feedback likely to reveal misconceptions during question and answer*
Communicative	Collaboration *None*	Discussion: class/ group *None*	Re-descriptions of concepts *None*
Adaptive	Diversity *Viewing of representations of descriptions of the world*	Reproduction: model/ role play *Use of videos to mimic real life experiences*	Concretising theory: practice *ICT used to bring life to theory. When they visualise ideas, they understand better.*
Productive	Articulation *None*	Micro worlds *None*	Knowledge construction *None*

Narrative

The teacher uses ICTs to present conceptual structure and to illustrate the process of developing it. When asked how he finds ICT useful he explains,

> *When I explain a complicated topic which needs to be broken down into steps you are able to say this step is number 1, this is number 2 so they are able to visualise that.*

His learners are able to see the steps followed in the process and the links between them. Moruti explains how learners get the benefit of his ICT utilisation by saying,

> *In the introduction I use visuals. Complex topics, when you want to show the interrelationship between 2 or more things. So that you can say, look, if it wasn't for this, this would not be happening.*

The example that follows serves to illustrate the above point on the topic, 'Settlement'.

> *…but settlement is a complicated thing, it involves many things, but through the use of ICTs, we are able to simplify it and break it down into steps and say now we are talking of the shape of the settlements, now we are talking of the benefits of a particular settlement, now we are talking of why this settlement is different from the other one. You are able to show that in the visual aids.*

It seems his incorporation of multimodal texts (visuals and written) helps to make the structure more meaningful to learners. He adds,

> *I can help make something complicated to be simpler so that at least they can get the basics at least they can understand before they can deal with it in its entirety. It will allow you to break down a thing to little slices and then more slices then they can see the full size thereafter. It makes it possible for you to do that, but it is not ICTs alone that does that.*

Although Moruti uses ICT to help learners acquire the basic structure by saying, "If you have ICTs it can only assist the process, but if you don't have ICTs, you can only do so much" in the last sentence of the extract above seems to be contradictory. This statement actually forms the main thrust of this study. Indeed, "it is not ICTs alone that does that", but an amalgamation of all that the teacher does in the class room to make learning possible.

Interactive

Moruti commends the ICT he uses for affording him the ability to present much content during the lesson, he points out how this can be a disadvantage where its presence promotes learner passiveness. But because he acknowledges the benefits of using them in the classroom, he disrupts their passivity by asking them questions on what they are viewing. By doing so, he believes this interaction enables learners to benefit from the use of visuals that are critical in the understanding of the subject.

> *Some learners don't see the seriousness of the activity, they become passive. So you have to make examples and then ask. Ask so that even those who are getting bored you bring them back to task.*

Interactivity is therefore not brought in through the use of ICTs, but because of its usage. This however accentuates the teacher's belief that ICTs are part of what brings value to a learning experience and what counts is that it is used meaningfully. On the other hand, Mpetha argues that the way materials are presented sustains learner interest in a presentation with ICTs.

Adaptive

This teacher believes, geography is a "visual subject" and that using visuals assists in helping learners understand complex matters especially when dealing with ideas that are not easy to demonstrate like those dangerous in real life. He says the following about learning of the subject:

> *You learn about things that you must see and some of those things are too far away from us. You are able to show that in visuals. So that if you just talk about them without visualising them, it's very theoretical, there is misunderstanding. But if you are able to create that picture, you are able to show the essence of the thing.*

Moruti seems to believe that to avoid misconceptions, learners must be presented with visual representations. However, on their own, descrriptions are still prone to be misinterpreted and the teacher does not indicate how this might be done as Mlingani, the mathematics teacher did. It is in the enacted practices that the state of this concern can be established.

Although this teacher perceives ICTs as adaptive tools, he emphasises how it is important for the user or the teacher in this case to have skills to modify what they afford to the benefit of a meaningful learning experience. The teacher argues,

> *So it saves time, but, it should not be a prison. It should not lead you to becoming inflexible, you still need the flexibility part. Remember you are dealing with human beings, they have different values they have different attitudes and they have different abilities. So always it has to measure up to the child. If it is up there and the child is down there, it is not helping the child, you have to somewhat drop it down to the level of the child.*

With experience and proficiency in the use of ICTs, he is able to adapt content to suit his learner needs.

Conclusion

Moruti's espoused practice with ICTs is a result of a long connection with digital technologies as a teacher. He seems not to have that excitement that other teachers have of discovering new ICT affordances and opportunities they incorporate in their teaching. His views uphold the belief that the teacher is the agent of change in an education system, with or without computers. The teacher's experience with teaching and proficiency with digital technology contributes in how he teaches with technology. He believes that ICTs cannot on their own enhance learning, rather it is the integration of many other pedagogical components that together make learning possible.

His pedagogical value for ICT use seems to evolve around narrative and adaptive media benefits. In his concern for effectiveness in facilitating cognitive development, Moruti emphasises the

importance of adapting content to learner level and using visuals to concretise abstract concepts. Benefits from the interactive media form come as a result of the negative use of ICTs on learners or rather it validates the teacher's conventional teaching approach where he uses question and answer to sustain learner attention.

Enacted practices

Moruti teaches geography to a grade 11 class in the library. This venue has a fixed scroll down screen and a data projector that he can use to project his slides. His class has about 30 learners sitting facing the screen behind long tables.

Figure 5.8: Moruti's classroom setup



Since the screen is positioned behind the wall on the right, the light from the windows does not reach it and as a result the projection is clear.

Lesson Observed

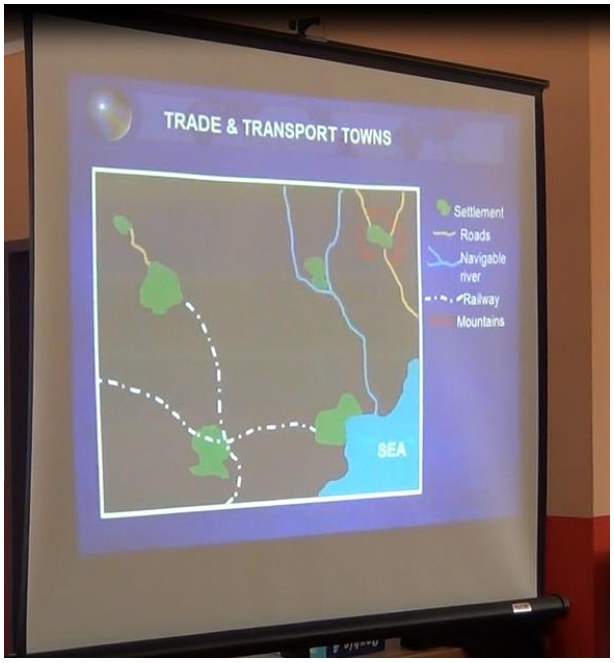
Topic: Settlements in urban areas

ICT used: laptop and data projector

Overview of the lesson

In this lesson, Moruti focuses on two types of towns (the central place town and the trade and transport town). The content he uses is a resource supplied by the Gauteng Department of Education (GDE). He uses two slides from it with each having a diagram that captures and illustrates the main characteristics of each type of town. The map has a Key that helps interpret the features that make it up and in his descriptions he justifies their existence in those towns. For example, with the following display on the slide he explains in the dialogue below:

Figure 5.9: Slide on trade and transport town



To explain this slide, Moruti says,

> *Teacher: Now the other town that we are going to deal with is what is known as a trade and transport town. Why is it a trade and transport town? It is a town that is formed because of trade and transport. In other words if there was no transport that town would not have been formed. Can I make an example of what I mean by that?*
>
> *Learners: Yes*
>
> *Teacher: When you move from here to Durban, half way along the way, you are going to need what?*

Learners give examples of fuel and food and then the teacher continues,

> *Teacher: …So here they are combining 2 things (showing with fingers). There is trade, there is transport. Any of them resulted in the formation of that town. In other words if they were not trading, if they were not selling things to other people who are passing by then they would not be selling things there. Do you understand?*

Learners respond by basically completing sentences and answering his questions as their contribution to the development of the lesson. The slide is simply displayed as a chart showing the key elements of the content to be covered.

This lesson is operating at a discursive phase in the Conversational Framework.

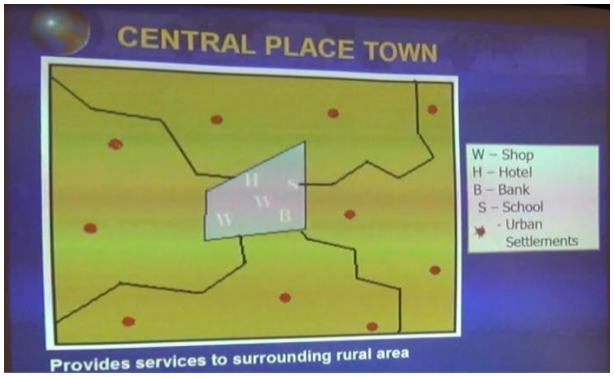
Table 5.18: Interpretation of Moruti's enacted practice

Media forms	Affordances		Evidence		What pedagogical value does it add?	
Narrative	Non-linear *Linear – provision of a visual presentation*	/	Multimodality *Map with key features of each type of town*	/	Content structure/ connections *Technology establishes and provides the key features for the towns described*	/
Interactive	Immediacy *Instant display*	/	Immediate feedback *Instant movement from one slide to the other.* *Teacher-learner interaction*	/	Misconceptions amended *The technical feature does not lead to identification of misconceptions. The cognitive level of the questions asked during the interaction do not reveal misconceptions.*	×
Communicative	Collaboration *Local example*	×	Discussion: class/ group *Class dialogue*	×	Re-descriptions of concepts *Since no misconceptions identified there were no re-descriptions*	×
Adaptive	Diversity *Visual representations*	/	Reproduction: model/ role play *Animation – appearance of slides*	/	Concretising theory: practice *The animation did not add to learner understanding. Instead, teacher use of local examples seems to help learner understanding of the descriptions.*	×
Productive	Articulation *None*	×	Product *None*	×	Knowledge construction *None*	×

Narrative

The pedagogic value that the map on each slide provides is a static structure from which the teacher is able to refer to as he describes the characteristics of each town. There was no movement from one media or modal text to the other in the teacher's presentation or use of the technology and therefore there was no evidence of non-linearity. In his lesson presentation Moruti uses the key points on the map to initiate the conversation or description of the concepts. Once completed, he simply moves to the next town and behaves the same. In describing the first slide for instance,

Figure 5.10: First slide



The teacher elaborates on the slide illustration as follows:

Teacher: A central place town provides services to the towns that surround it.

Making sense?

Learners: Yes

Teacher: An example of those services would be when we find a shop, ne?

Learners: Yes

Teacher: Okay? A shop is just not there for. You don't build a shop and sell to your family only, ne?

Learners: Yes

Teacher: You build a shop, you sell to the people in your area and other people who stay in other areas buy from your shop.

Teacher: Alright?

Learners: Yes

Teacher: Now, we also have hotels there, besides the hotels, A hotel will be used by the people who stay in town and also by the people who are visiting the town as well, people like tourists. So it serves as a central function. You understand that, ne?

Learners: Yes.

The conversation continues this way with the teacher explaining each feature of the map and when all has been described he moves to the next slide as follows:

Teacher: It's good (Changes the slide). Now the other town that we are going to deal with is what is known as a trade and transport town.

All learners are required to do was respond to these lower level questions or completed statements that were leading as he developed the concept.

Interactive

Interactivity as a value for the teaching and learning experience seems to remain at the level of operating the technology. This seems not to have an impact on cognitive development as the non-linearity which should promote it is missing. The classroom dialogue that takes place provides space for interactivity between the teacher and learners, but because the level of engagement expected from learners remains at comprehension level, misconceptions do not emerge. The following pattern and level of question and answer dominates the dialogue:

Teacher: A central place town has what? It provides what? Services to the town area. In other words those services are the services which the other towns don't have. But they depend for the provision of those services

from the central place town.

Teacher: Making sense?

Learners: Yes

Teacher: Making sense?

Learners: Yes

Teacher: Can we repeat that?

Learners: Yes

Learners are simply agreeing with the teacher. If for instance all makes sense, then why would learners agree that the teacher repeats? It is also possible that those who want the description repeated are those who have misconceptions. In other words, because the level of interaction does not make explicit learner descriptions it becomes difficult to determine if all understand.

Communicative

In this particular lesson there is no activity that is collaborative as it is the teacher that transmits the subject matter. Towards the end the teacher engages learners in completion of sentences and while this may seem like a collaborative activity there is no sense of responsibility from learners as expected in a collaborative activity. For instance,

Teacher: When you move from here to Durban, half way along the way, you are going to need what?

Learners: Fuel

Teacher: Fuel, ne? Half way along the way you are going to need what?

Learners: Food

Teacher: Half way along the way you are going to need food. So that place will be there because you are using transport from here to

Learners: Durban

Teacher: Durban. So that town will be a

Learners: trade and transport town

Teacher: Transport town. Okay?

Learners: Yes

The main thing here is that the use of technology and the conversation do not promote collaboration that should lead to re-descriptions once learner misconceptions are exposed.

Adaptive

While the teacher's use of visuals (the map) might seem to be promoting understanding by learners of different abilities, the fact that these are not representations of real objects might not be as effective, although that depends on the clarity of the interpretation of the symbol. The animation used does not seem to add value to learning except that the teacher is able to smoothly move from one slide to the other.

In his conversation with learners, the teacher uses examples of local towns and features, and that also helps learners relate theory to what they are familiar with. The example in the dialogue above and learner contributions seem to show they are able to link the descriptions of the world and those about the world.

Conclusion

What makes it difficult to determine the value in Moruti's teaching is that learner feedback that can be used as evidence that learning is taking place is not explicit. That does not mean that learning is not taking place as his teaching approach is used from that proposed by the Conversational Framework.

The ICT used in this library provides learners with a fixed structure that is utilised to initiate classroom conversation. It is therefore mainly used as a narrative media form. Once the content is displayed on the screen, it is used as a starting point to deal with a particular aspect of the concept that is represented on the diagram. There is no integration of other teaching methods, media (digital or non-digital) or text as the teaching happens and for that reason, there is no linearity in his usage. The interaction between the teacher and learners does not give feedback that can be used to identify misconceptions and for that reason, their value cannot be confirmed using Laurillard's (2002) framework. However the teacher's interpretation of the structure provided by the ICT seems to enhance learning. Moruti's use of digital technology in the classroom has not incorporated its use as communicative and productive media.

Analysis of coherence of teacher espoused and enacted practices

Moruti's espoused and enacted practices is coherent and what seems to be the driving force in that regard are the following extracts that tend to express his stance with ICT use in the classroom.

1. *I wouldn't say it's the ICTs only. I would say it has contributed partly to the improvement.*
2. *In other words using ICTs as an experienced teacher enhances your performance to an extent, because you see, ICTs cannot close up lack of capacity.*
3. *I can help make something complicated to be simpler so that at least they can get the basics at least they can understand before they can deal with it in its entirety.*
4. *It makes it possible for you to do that, but it is not ICTs alone that does that.*

Although this study agrees with these assertions, Moruti's enacted practices make it clear what he means that is not in full agreement with this study as indicated earlier in the interpretation of his espoused practices. In all statements Moruti indicate some restrain in the ICT affordances and that could be the reason why much as there is coherence in the two practices, his teaching seems to draw little from what they can do for him as an experienced teacher. There seems to be a contest here between the teacher and the digital technology. He is experienced and the ICT will not replace him. For that reason digital technology plays what seems to be an insignificant role while he as the teacher teaches. Having made these observations that seem to justify the extent to which Moruti engages ICTs in his teaching, his engagement of each media will be discussed to try and make clear the coherence of his practices.

Moruti believes his main use of the ICT is for presenting structure and demonstrating conceptual processes. This, he does in his teaching but what seems to make the difference is the limited engagement of the ICT in his presentation. It is basically restricted to a hard and flat (immovable or linear) display of content organisation. Once projected, the teacher takes over and interprets the display in his conversation. When Moruti says in his espoused practice that there are teaching methods that are part of what ICTs do, it seems he is referring to the two (question and answer and examples) which he used in his actual teaching.

The extent to which he uses the interactive tools in his conversation seems to be influenced by his style of teaching. Learners do not contribute much to the descriptions of the knowledge as their feedback does not make explicit their actual level of development or how they understand what the teacher is saying. In his espoused practice Moruti mentions that learners become passive when he uses the ICT. Based on the non-linearity, the materials design and teaching style, it is possible that learners are simply responding to the learning environment he has created with ICTs. To keep

learners ‘involved’, Moruti says he asks them questions and gives them examples which he does in his enacted practice. What was observed though is that the involvement brought about by these teaching methods are minimal and not engaging them in higher levels of thinking. It is such thinking skills that facilitate knowledge construction.

It seems knowledge construction at learner level is not part of his plan in both practices. Communication is not engaged either and this could be a result of the teacher taking the position of one in possession of knowledge and imparting it in the classroom. Although Moruti has had more years teaching with digital technology (5 years) his pedagogical beliefs about the trivial role that the ICT plays seem to constrain him from maximising the utilisation of digital technology in his classroom. That could also be the reason why his perception of the ICT tool is restricted to the limited role he wants it to play. On the contrary, teachers who applaud the power of digital technology engage them in a way that their significance is felt but not seen.

The use of the ICT as an adaptive media form is coherent in both practices and what the teacher implies by pedagogical value from the presentation of visuals seems to be limited to the static display to present structure. It is possible that videos are used in other lessons as he indicated in his espoused practice. What was observed though is that Moruti relies on his talk in the descriptions of the structure and nothing else.

Overall conclusion

Moruti’s espoused practice seems to have an element of restrain as he is adamant that ICTs cannot be given credit to the successful teaching. However because he is aware of the benefits of ICTs in helping learners apprehend structure that places his ICT pedagogical value at a high level. In his enacted practice, Moruti constrains his ICT pedagogical value to the narrative form as indicated in the espoused form, but because its engagement of the technology is linear, that places his value at a low level. This teacher’s practice is therefore inconsistent.



Bambisana

Teacher description

Bambisana teaches geography in School F. She uses her own laptop and a school data projector to project slides in a whiteboard in front of her classroom and teaches all her lessons with it. She has not attended any ICT teacher training and she has taught herself how to operate the computer she uses.

Espoused Practice

This teacher believes that her subject nature demands that ICTs be used and for that reason, she integrates them into her teaching.

> *Always. In every lesson. I use them to teach the learners especially when it comes to visuals. Because when you teach the learners, my subject needs a lot of visuals because some of the things happen where they have never been.*

She also believes she becomes more productive with the use of ICTs in the classroom.

> *But using them, they are wonderful and I can teach more than I can when writing on the board.*

Her other reason for using ICTs is that it supports her belief about teaching.

> *It's something they see they enjoy (smile), it captures their attention. When teaching, the most important thing is attention. Learners cannot understand without paying attention. When you use IT for example when you show them, as I was saying those rocks, you find that one can even hear a pin falling, they are glued, there is oos and ahs.*

It is possible that the material Bambisana uses naturally draws learner attention which is of value if they will understand new knowledge. One of the affordances that she values in ICTs is its ability to display different texts like 'visuals' and video. When asked if she has seen any learner performance improvement since she started using ICTs she responds,

> *Ah, a lot (smile). A lot of improvement, I'll talk about the grade 12s. You, when it comes to this section I am teaching, geomorphology, when it comes to land forms, they were able to identify landforms and they said you know, when you show this is what I am talking about. They see them in the text book but though CAPS is trying, it is more of*

picture orientated. But when they see it on a big screen (smile) you know, they understand more than when you teach learning in a textbook.

She believes display on a big screen has an impact on her learners' attention and that makes it a better resource compared to books and its images. For some learners she says it is the only resource they have as they do not have text books. Her use of ICTs is for emphasis and extension of concepts. She explains first without ICTs and brings them in to get feedback. It is for that reason that she uses it during the following parts of his lesson.

I can say when you introduce the lesson, because when you use IT you catch the attention of the learners. And in the middle now it's done to help learners understand what you are talking about. You can conclude without IT as long as you have introduced what you are going to teach about using IT.

Her reason for using ICTs it seems is based on her attempt to fulfil her beliefs on teaching her subject which are attention and use of visuals to help them understand. Her understanding of ICT integration is as follows:

It is my teaching which I used before without IT, now getting into IT it makes life easier for one. Ha, it makes life easier and saving time, saving paper because some of the things you don't have to print, you just use your IT.

The IT she is referring to here is the computer and her description captures what literally happens when integrating ICTs. The teaching she used before is the conventional teaching which is enhanced by the IT. The table below illustrates how Bambisana believes she uses ICTs to enhance her teaching and learning based on the analytic tool developed for this study.

Table 5.19: Interpretation of Bambisana espoused practice

Media forms	Affordances	Evidence	What pedagogical value does it add?
Narrative	Non-linear *Display different modal texts*	Multimodality *Images, audio and video*	Content structure/ connections *Usage draws learner attention which facilitates understanding through use of 'visuals'.*
Interactive	Immediacy *Coverage of more within a short time*	Immediate feedback *Learner attention*	Misconceptions amended *Visuals help amend misunderstandings and thus deepen understandings*
Communicative	Collaboration *None*	Discussion: class/ group *None*	Re-descriptions of concepts *None*
Adaptive	Diversity *Access to local and global events to all in the classroom*	Reproduction: model/ role play *Audio and videos of occurrences taught*	Concretising theory: practice *Concretisation of out of reach and abstract occurrences enrich understandings of concepts*
Productive	Articulation *None*	Product *None*	Knowledge construction *None*

Narrative

The teacher's beliefs that learners understand better with visuals is influenced by her understanding of her subject and teaching. She says,

> *Because when you teach the learners, my subject needs a lot of visuals because some of the things happen where they have never been. Even questions. Pictures and visuals and audio visuals.*

By visuals, Bambisana probably refers to different modal texts that show images in different forms. She believes a display of these images draws learners' attention.

> *It's something they see they enjoy (smile), it captures their attention. When teaching, the most important thing is attention. Learners cannot understand without paying attention.*

Bambisana believes it is when learners are attentive that they are able to understand better, more so that visuals are used. ICTs are used followed by the explanation and that is the pattern formed. Although the teacher's use sounds as if it is linear, that depends on how classroom conversations steer the infusion of the visuals. Understanding geographical concepts is apprehending structure. It is not clear at this stage how Bambisana uses the visuals in the introduction to capture learner attention but if they are used after the explanations they could be used as adaptive media which will be discussed latter.

Interaction

The immediacy affordance of the digital technology enables Bambisana to cover much over a short period of time. It is not clear at this stage if what she covers is content or the display of diverse images. Either way the feedback she gets, which is learner attention could be suggesting that they get to understand and that way their misconceptions are amended. The following extract seems to suggest that.

> *When teaching, the most important thing is attention. Learners cannot understand without paying attention.*

This type of feedback seems to relate to Laurillard's (2002:126) intrinsic feedback because it "is internal to the action that cannot be helped once the action occurs". Although the Conversational Framework advocates that the feedback must be meaningful to the student, it can be assumed as the teacher claims that the use of visuals promotes the amendment of learner misconceptions (internally).

Adaptive

This teacher's value of ICTs is associated with her belief about learning geography. She believes, once learners view a geographical occurrence, they are able to grasp the concepts related to it.

> *Remember some of them don't even have textbooks, but when you use the visual everybody's eyes is screwed there, they are able to see. And when it comes to performance, the performance improves a lot.*

Based on the extract above, learners' performance improves because of the use of visuals.
In addition, she helps learners adapt to new understandings by presenting audios and videos of ideas that they are not familiar with. The teacher believes these re-defined experiences help emphasise and extend learner understandings. She says,

> *You explain them first and then in order to see that they understand you show them visuals and then you ask them to answer. I can say both, to emphasize what I am talking about and then to extend their understanding.*

When dealing with more abstract concepts, Bambisana first explains them and then shows visuals, perhaps as an emphasis or to further extend their understanding.

Conclusion

Bambisana's pedagogical beliefs about the value of ICTs are based on her intention to endorse her understanding of how geography is and should be taught or learnt. It is important to her for learners to be attentive (says this four times in the interview) if they will understand. In addition to that, visuals play a big role in helping learners understand new geographical concepts. These characteristics do not only assist in apprehending structure but in adapting learners to new understandings. It is for that reason that a conclusion can be made that her ICT pedagogical value is based on the knowledge structure of her subject and its ability to sustain learner attention.

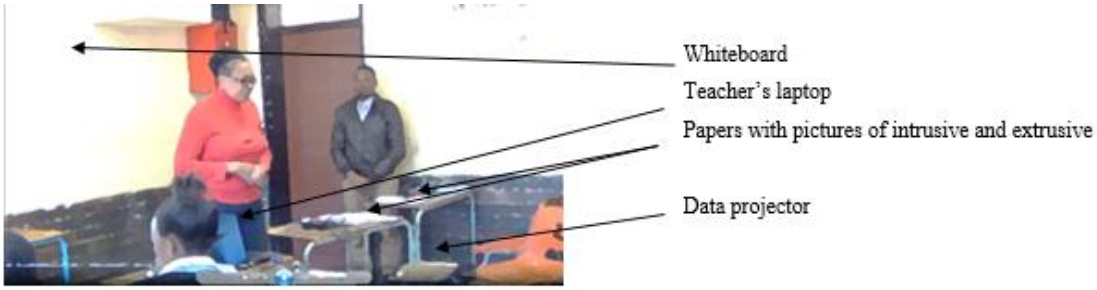
Enacted practices

Bambisana uses a laptop and a data projector to teach geography to a grade 10 class in her classroom with about 40 learners.

The classroom has a whiteboard on which the slides are projected. The projection occupies part of the board and a narrow section on the right is left and used by the teacher to write and draw sketches of the different types of intrusive and extrusive

forms. Although the classroom does not have blinds, there is not much light coming in as the windows are positioned at a level higher than that of the whiteboard.

Figure 5.11: Bambisana's classroom setup



This teacher usually operates the laptop on her own, but today she has requested a student teacher she is mentoring to act as a technician. His role is to move from slide to slide at the instruction of the teacher while she focuses on teaching. This teacher uses the slides, the remaining part of the whiteboard to write and draw sketches of the forms and also uses papers placed on two desks as resources for this lesson.

Lesson Observed

Topic: Intrusive and Extrusive Forms

ICT used: Laptop and data projector

Overview of the lesson

Bambisana introduces her lesson by drawing learners' attention to the two different representations of intrusive and extrusive forms in two different slides and explains why both illustrations (2 and 3 dimensional) are critical in learning geography and preparing for examinations. As she explains the rest of the forms she consistently engages both – 2 dimensional (2D) and 3dimensional (3D) representations. She spends most of the time interacting with learners as they respond to questions displayed on the screen. Learners have them in their books as well and when she is explaining an aspect, they are able to refer to their books. As each intrinsic form to begin with is matched with the description, the teacher, with her learners coming in and expands on the description. A paper on either table is selected to show learners a particular feature represented in 3D and in black and white that seems to be additional information to show learners as she elaborates on these forms. The teacher uses the slides in colour and in 3D to elaborate on her explanations which are represented diagrammatically by the teacher on the whiteboard, next to the projection on the screen. Later the teacher moves to exclusive forms and this is an introduction of land forms, geographically justifying their shapes and formation. As Bambisana teaches she consistently draws from learner past

experience, images on paper and in their exercise books, the slides and her drawings. Lastly, the class asks questions on content covered and again the teacher uses these different sources of information, including the slides to respond to them. This learning activity operates at the adaptive phase because the teacher has prepared resources that serve to create an environment where she can "use the relationship between their (her) own and the student's conception to determine the task focus of the continuing dialogue" (Laurillard, 2002:78). The following table indicates the frequency of usage of the resources engaged in this lesson.

Table 5.20: Frequency of resources used

Media	Total number used	Detailed distribution of usage	
ICT	17	11/17 – 2D and 3D images	
		2/17 – task display	
		4/17 – response to questions	
Whiteboard (drawing and writing)	10	5 – written text	
		5 - drawing	4/5 – explanations
			1/5 - response to questions
Paper	4	3/4 – explanations	
		1/4 – response to questions	
Object (in the classroom)	2	Explanation	
Books – learner resource	1	Definition read	
Total	34		

There is more use of digital technology than other resources and each seems to serve its purpose in the teaching experience. Based on the total number of usage of all resources, there is balance between ICT use and other (non-digital) technologies. The detailed distribution will be used in the explanations of the interpretation table below.

The teacher seems to be concretising the theory lesson the class has covered before as learners are able to offer their conceptions on the content in discussion. Bambisana seems to engage the interactive and adaptive phase in this phase as she extends learner understanding depending on the feedback she gets. The discursive phase is engaged to introduce the extrusive and this seems to prepare learners for the second part of the adaptive activity. The following figure attempts to locate pedagogical value in Bambisana's use of ICTs in this lesson.

Table 5.21: Interpretation of Bambisana's enacted practice

Media forms	Affordances		Evidence		What pedagogical value does it add?	
Narrative	Non-linear *Display of task and visual images in different forms.*	/	Multimodality *Multimodal texts and media*	/	Content structure/ connections *The different types of representations provide the teacher with visible justifications, explanations, links and extensions of the features he is teaching about.*	/
Interactive	Immediacy *Pulling the resources needed just-in-time*	/	Immediate feedback *Visual images from different sources. Teacher-learners interaction*	/	Misconceptions amended. *Visual images used to amend misconceptions revealed from learner feedback*	/
Communicative	Collaboration *Providing a platform that makes vivid the concepts discussed*	/	Discussion: class/ group *Class works cooperatively as the lesson progresses*	/	Re-descriptions of concepts *The interaction facilitates re-descriptions as the teacher makes clear learner enquiries and misconceptions by using visual images.*	/
Adaptive	Diversity *Concretising unreachable characteristics*	/	Reproduction: model/ role play *Examples given are from local and common events. These are linked with the visuals.*	/ ×	Concretising theory: practice *This is executed by the teacher as she represents 3D with 2D drawings she displays and draws.*	/
Productive	Articulation *None*	x	Product *None*	x	Knowledge construction *None*	x

Narrative

As a narrative form the ICT is used together with non-digital and other teaching methods that are engaged when the teacher introduces the extrusive forms, a second concept in this adaptive phase. Table5.20 shows the shifts the teacher makes from one media and strategy to the other in the whole lesson but he especially engages it 5 times as a narrative media form. When he does so, there is non-linearity in his integration of different technologies. For instance, in addition to the ICT, he switches between the whiteboard and the object (edge of a desk) he uses to demonstrate the effects of erosion. She also makes reference to local knowledge of extrusive forms: For example:

> *Teacher: Can you give me one example of a flat topped mountain in South Africa? (Hands go up*
>
> *and the teacher calls the name of one learner)*
>
> *Learner: Table Mountain*
>
> *Teacher: Table Mountain is the most known mesa (points at the word written on the whiteboard)*

Thereafter, the teacher uses this link with what learners know about Table Mountain to extend their understanding of a mesa. She then uses the slide to show how a flat mountain like Table Mountain can be deformed to another form (a butte) due to erosion. The whiteboard is used to draw 2D representations of photographs on the slide. As Bambisana offers these descriptions he interacts with his learners as described in the next section.

Interactive

As Bambisana describes both intrusive and extrusive forms she draws from both digital and non-digital resources and demonstrations using objects in the classroom to make vivid these features. As she does so, she asks learners questions that mainly relate to what has been covered in previous lessons or information about local rock forms. The feedback that she gets seems to prompt her to use representations from slides to amend the misconceptions or to establish their understanding so she can move to the next form as illustrated in the narrative extract above. The teacher also uses learners to amend misconceptions as in the following extract:

> *Teacher: Let us come to the pipe*
> *Learner 1: (reads the definition from the book)*
> *Teacher: Yes, the the the thing that …(not audible) away is itits reaching the earth's surface and when it reaches the earth's surface what happens sometimes?*
> *Learner 2: I think… (not audible)*
> *Teacher: When I see it outside do I call it that?*
> *Learners: No*
> *Teacher: What do I call it?*
> *Learner 3: Lava*
> *Teacher: And then we have a seal. What is a seal? Yes (to a learner raising her hand)*
> *Learner: It is a horizontal … (not audible)*
> *Teacher: Yes. Let us see if we have got it by the second. (looks for it from the slides)*

This immediacy makes it possible for Bambisana to pull and incorporate images of each form she covers in her lesson and when learners ask her questions towards the end of the lesson.

Communicative

The visual representations promote interaction between the learner and the teacher and as that happen misconceptions are revealed. The interaction is not so much a collaborative activity but the main thing, particularly for this adaptive phase where the teacher offers re-descriptions as a result of the feedback he gets from learners. In fact it seems the visuals are playing a big role in establishing

understandings of concepts that have been covered. She uses it mainly as an adaptive media as explained in the next form.

Adaptive

The frequency of Bambisana's use of resources seems to be aimed at concretising the theory covered in the previous lesson as already been pointed out. The teacher is using the task given to make clear the differences in the descriptions of forms covered. The evidence for the ICT use is not simulation, but through the use of the conversation and the resources used, learners are able to see the differences in the forms and their representations. The evidence from Table5.20 shows how determined to help learners actually see how the forms look like, how different they are from each other and how they are formed. Learners have their books with examples of these extrusive and intrusive forms, but in addition to that, Bambisana uses 4 additional resources. As already been indicated, the ICT is used half the time of other technologies.

Conclusion

In this lesson, Bambisana has made an effort to adapt learner understandings of the theory they have covered in the previous lesson. She is able to demonstrate how visual the topic she is covering and engages different media, digital and non-digital to try and make explicit the differences in the descriptions of the forms. Although this teacher is using the task goal to move from one form description to the next, her conversation seems to rely on learner feedback for lesson progress and amendment of identified misunderstandings. While she does not seem to have the skill to animate or embed other media in her electronic resource, her engagement of different media and her descriptions seem to suffice in achieving the understandings required for this grade. It is for that reason that perhaps the analytical framework used here needs to include an alternative for simulations for instance.

Analysis of coherence of teacher espoused and enacted practices

What Bambisana does with the digital technology she uses is based on her belief on how the subject should be taught and learned. While that is a factor in her value for ICT use, unlike the previous teacher (Moruti) she also believes ICTs have an affective influence on learners. These two main elements that seem to make up her espoused practices are resonated and amplified in her enacted practice.

To begin with, the interpretation through the analytic tool indicates that this teacher engages most of the media forms in both practices. The communicative media form as in most teachers has been added. What is outstanding about Bambisana's teaching is her effective engagement of other

technologies in addition to her ICT usage to enhance her classroom conversation, something that has not emerged in her beliefs.

In her use of ICT as a narrative media Bambisana emphasises her use of digital technology to help learners apprehend structure and this seems to be facilitated by the atmosphere it creates that makes them attentive. In the lesson observed, it was of interest to see how she was able to create this desirable atmosphere. She is able to make visible what she taught through different representations and media (multimodality) that sustained her learners' attention on her description of structure. Her learners are 'screwed there' as she states in the interview. The advantage that the ICT seems to have over other technologies is its immediacy and its ability to show colour in the representations, by so doing making the differences in the forms more vivid.

Although in her response Bambisana seems to imply that her integration of ICT is linear, as she starts with theory presentation and then the integration, her enacted practice rectifies this misunderstanding. The lesson that she teaches is a follow up lesson from the previous theory lesson and this one is aimed at concretising theory by presenting these visuals. It is an adaptive activity and each rock form has its representation at times in different ways to help them see and understand the distinct characteristics of each formation. The links in the presentation of structure were not made clear in her descriptions but here presentation demonstrates this aspect as she moves from one mode to the other to try and make explicit the structure, its formation in relation to other forms and their formations. What seems to enhance this non-linearity in her attempt to connect structure is the interaction she maintains in her teaching.

To begin with, Bambisana seems to imply that the feedback she gets from learners by being attentive facilitates amendment of conceptions as she presents visuals. This is clarified in the enacted practice extrinsic feedback seems to play a big role in identifying misconceptions and amending them with the use of visuals, mainly from ICTs. Learner questions encourage the teacher to extend learning by using connections and different representations to establish conceptual structure and offering re-descriptions.

In both practices, ICTs are used as adaptive media forms, to help learners see the concrete forms of what they have learned. In this activity the teacher has prepared visuals so as she explains learners see what she is talking about. That does not end at the display of the visuals but the teacher also links prior and knowledge about local related structures to help learners personalise the concepts learned. As this media form is engaged, global knowledge is linked with local knowledge to

establish understandings and as this is done theoretical understandings are made practical and real, making it easier for learners to internalise the knowledge.

In her espoused practice, Bambisana does not mention ICT use as communicative and reproductive media but her actual teaching seems to be characterised by re-descriptions, an aspect placed as a pedagogical value for communicative media. The question now to be asked is if that means the activity is communicative when it only happens at class level. The class does communicate verbally and it can be said that knowledge or the establishment of understandings is carried out collaboratively as both the teacher and learners interact to achieve the task goal. The fact that learners do not engage in any productive work could rule out this media form but as has been concluded in other teachers, the level of engagement at this adaptive learning activity prepares learners for productive engagement.

Overall conclusion

In her espoused practice, Bambisana explains what the demands for learning geography are and how ICTs do not only help learners pay attention which she values as precedence to learning, but for facilitating apprehending of content and for concretising new concepts through use of visuals. This realisation of learning needs for her subject places her ICT pedagogical value at a high level. In her enacted practice Bambisana engages ICT affordances to establish her learner understanding by integrating them with other teaching resources. The pedagogical value of ICTs is thus at a high level as it is able to support other teaching resources and strategies as the teacher tries to describe different parts of the land forms.

Summary of pedagogical value within teacher espoused and enacted practices with ICTs

In order to accentuate the influence that teacher beliefs have whether pedagogical or not on their actual teaching, this study will highlight teacher descriptions emerging from the interpretations carried out in this chapter. The descriptions encompass the main teacher beliefs about their ICT pedagogical value in both practices and their consistencies. In the first column are the key words the teachers used to describe ICT pedagogical value. The next two columns represent a condensed interpretation of the teacher practices. The last column determines teacher practice consistency and how it rates in terms of high (H) or low (L) pedagogical value. High simply means there is evidence that there is pedagogical value. Low means there is little or no evidence that there is pedagogical value in the teachers' espoused or enacted practices with ICTs. The first letter represents the score for espoused and the second for enacted practice as justification for the consistency decision made by this study.

Table 5.22: Summary of teacher practices and their consistencies

Teacher & Key value	Espoused ICT pedagogical value	Enacted ICT pedagogical value	Is there consistency in the practices?
Mshini Managing	Narrative: non-linear, multimodal texts Interactive: Immediacy- more content	Narrative: written text display Interactive: only questions displayed	H + L = No
Sizakele Convenience	Interactive: Immediacy- mobility to cope with school timetable structure.	Interactive: Immediacy – more content with limited time for structure interpretation	L + L = Yes
Takalani Retention	Adaptive: non-linearity (visuals) Interactive: Immediacy- assessment	Narrative: linear -written text display Interactive: ICT feedback no amend.	H + L = No
Mpetha Process	Narrative: process and links Interactive: feedback to enrich learning Adaptive: material design for diversity Communication: collaboration, group Productive: modelling	Narrative: non-linearity, process/links Interactive: immediacy, feedback Adaptive: concretising concept, design Communication: collaboration, class Productive: modelling, group work	H + H = Yes
Mlingani Partner	Narrative: content structure Interactive: immediacy Adaptive: language and thinking skills	Narrative: content structure – ICT Interactive: immediacy, interchange Adaptive: teacher interprets structure	H + H = Yes
Moruti Not on ICT only	Narrative: non-linearity, multimodality Interactive: immediacy – more content	Narrative: linear, map Interactive: immediacy – map display	H + L = No
Bambisana Understanding	Narrative: multimodality Adaptive: attention and understanding	Narrative: non-linearity, multimodality Adaptive: concretising theory	H + H = Yes

The content on this table presents an outline and justification for the responses to the first research questions presented at the beginning of this chapter.

Consistency does not necessarily mean there is pedagogical value in the teacher's ICT integration, but simply means the espoused and enacted practices are coherent. It is also clear that the relationship between teacher espoused and enacted practices is distinct per teacher as their beliefs and teaching needs differ as indicated on the table above.

Chapter Conclusion

In general, ICTs are valued for their ability to present concept structure and that is what seems to be coherent in all teacher practices. While digital technology plays this role, teachers through conversation interact with their learners in different ways as they try and interpret the meaning of structure. Each of the 7 teachers seems to have his or her individual pedagogical belief or understanding about ICT integration, whether misconceived or not, that influences their enacted practice. In the case of misconceived beliefs as in the case of Sizakele and Takalani, the value of ICTs is compromised and focus is placed on the technology. On the other hand, Moruti, seems to understand the role ICTs should play in the classroom to supplement teaching and yet his usage is restrained by this belief as he seems to ensure this technology does not dominate over him as the teacher and by so doing he minimises the potential and the skills he has to advance his lesson presentation. This chapter has revealed what and to what extent the pedagogical value is within each

teacher's espoused and enacted practices with ICTs and used that to determine their consistencies. This study will engage these variables to try and consolidate these findings for the benefit of the ICT training framework to be developed for South African teachers.

The next chapter is a document analysis which attempts to understand what the South African education system values and relate it to that of the teachers. Once the relationship is confirmed, the study will be able to discuss and identify what is of pedagogical value in this country's education context.

Chapter 6

Pedagogical value of ICTs espoused by the South African education policies

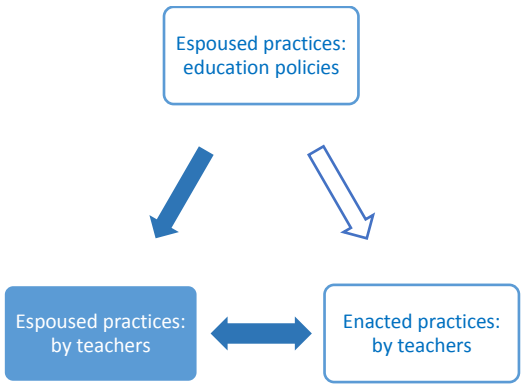
Introduction

This chapter is examining the policy component of the context from which this study is operating from and the intention is to try and map what prevailing South African education policy considers of pedagogical value in the use of ICTs, as reflected in the CAPS document (which contains the curriculum for all subjects) and the three ICT in education policy documents designed to support the curriculum statement. Later, the consistency of the relationship between these policies and the teachers' practices is investigated to try and determine if the policy framework is adequate as a workable account of ICT integration that reflects the pedagogical value that teachers portray.

This chapter intends responding to the following research questions:

4. What role do the policies play in the pedagogical use of ICTs by teachers?
5. To what extent are teachers' practices consistent with the assumptions of policy framework?

The following figure modified from that in Figure 1.8 in Chapter 1 illustrates the focus for this chapter in the context of the data collected for this study.



Although the other 2 dimensions in this triad have been dealt with in the previous chapter, the last section of this chapter will draw from its outcomes to determine the alignment of the teachers' ICT pedagogical value with those of the education policies. It is hoped that the relationship between and

within teacher practices and policy framework could indicate ways of closing gaps that seem to exist between policy and policy implementation. The deliberations would then inform the development of an ICT teacher training framework that can empower teachers to use ICTs in a way that brings pedagogical value to the teaching and learning process.

The four policy documents will now be introduced by presenting the aim and a concise explanation of how each one of them is relevant to this study. A description of what each policy says with regards to ICT usage in the classroom follows. Later, an evaluation of the policies as a collective is carried out in the context of this study's analytical framework in order to determine the extent to which they make explicit what should be of pedagogical value in the use of ICTs. Thereafter, teachers' compliance will be assessed, based on what the policy framework advocates.

The four policy documents that will be interpreted in this study are as follows:

1. **The Curriculum and Assessment Policy Statement** (CAPS), (DoE: 2010) is the National Curriculum Statement (NCS). It provides the general aims for the curriculum. The curriculum contains content for each subject and what is of pedagogical value including the resources that can be used to deliver and assess it are prescribed.
2. **The White Paper on e-Education** (DoE:2004) is the ICT in education policy and is subordinate to the Curriculum and Assessment Policy Statement (CAPS). While its role is to elaborate specifically in the terrain of ICT pedagogical integration, it also gives guidance on how digital technology can be used in a way that brings value to teaching and learning and the achievement of curriculum goals.
3. **The Guidelines for Teacher Training and Professional Development in ICT** (DoE: 2007) supplements the ICT in education policy. Its aim is to provide guidance on the ICT knowledge and skills teachers need to implement the national curriculum.
4. **The Guidelines on the Management and usage of ICTs in Public Schools in Gauteng** (GDE:2011) gives direction on how teachers in Gauteng schools should pedagogically Integrate ICTs in their context/s to productively use ICTs for their teaching. All teachers in this study are employed in this province.

What policy documents say about ICT pedagogical integration?

An overview of what each policy says about the use of ICTs in the classroom will be provided.

CAPS Document

Although a detailed description of the curriculum goals has been presented in the literature review (Chapter 2), this section is focused on what the document states about how ICTs should be integrated into the teaching of the various subjects.

The curriculum goals in the CAPS (DoE, 2012) document provide teachers with guidelines on the quality of learner outputs they should produce in their practice. With that information, teachers can create ideal teaching strategies, learning environments and learning experiences as they equip learners with skills, knowledge, attitudes and values desired by a curriculum that is informed by the society they are being prepared for.

In addition to the goals, this document presents subject content, the teaching approaches with the aims for teaching each subject and the assessment methods and structures that should be used for each grade. All this information provides teachers with a body of knowledge they should work with and is used to determine what is of pedagogical value. The suggested resource materials that teachers can use to support their teaching are non-digital and or digital in some cases.

The **Physical Sciences** curriculum includes both physics and chemistry. In the FET phase, the policy aims at making learners aware of their environment and to equip them with investigating skills related to physical and chemical aspects. Reference is made in this policy to ICT affordances that teachers can use to enhance learning of specific topics. For instance, in the teacher guidelines for the grade 10 unit, 'Atomic Structure', teachers are given additional information on how certain topics should be handled. The guidelines (DBE, 2011:20) also advise,

> *Visualization is very important in Chemistry to demystify the subject and make it easier to understand. Always move between macroscopic and sub- microscopic and use symbols effectively.*

Flexibility in the resources that can be used for the grade 11 topic on chemical bond, (DBE, 2011:67) suggest teachers,

> *use any suitable teacher support material that discusses the use of models in science, its benefits and short comings.*

The grade 12 guidelines on the topic, 'Organic molecular structures' also points to the use of visual aids that can be sourced such as "simulations and animations of molecules and organic reactions" (DBE, 2011:104).

The practical activities indicate what learning experiences learners can be exposed to and for the grade 12 topic for instance, Acid – base reactions, the resource material section suggests, "There are useful animations of titrations available to use here" and then it gives an example of Greenbowe animations. Under the Skills for Physical Science Learners section, amongst the list of seven resource materials that can be used to help learners develop the skills, is the internet, (DBE, 2011:154). There are indicators that teachers are encouraged to use ICTs in this subject.

The policy includes digital resources which are less compared to non-digital resources suggested though. This study identifies at least one instance where ICTs are made reference to in each FET grade. The rest seems to be left to teachers to discover resources that would work for their classroom contexts.

The description of **Mathematics** in the policy offers highlights different representations that need to be incorporated in this subject's learning environment. In the following extract (DBE, 2011: 8) from its description it says,

> *mathematics is a language that makes use of symbols and notations for describing numerical, geometric and graphical relationships. It helps to develop mental processes that enhance logical and critical thinking, accuracy and problem solving that will contribute in decision-making. Mathematical problem solving enables us to understand the world (physical, social and economic) around us, and, most of all, to teach us to think creatively.*

This description highlights the fact that while mathematics is a language of symbols there are thinking skills that need to be developed if learners are to cope with the demands of this discipline.

The sections that this study finds relevant in this curriculum statement are the Specific Aims, Specific Skills, Overview of Topics and Assessment. The aims specify the outcomes for teaching of mathematics. For instance teachers should develop learner computational thinking, use realistic examples, give real – life problems and make it accessible to all learners considering their diverse needs (DBE, 2011).

Amongst the skills that should be developed by the teacher is the correct use of mathematical language, "use of mathematics process skills to identify, investigate and solve problems creatively and critically" also, to "communicate appropriately by using descriptions in words, graphs, symbols, tables and diagrams" (DBE, 2011:9). The knowledge of ICT affordances and how they can provide these experiences become important in this case and the skills of how to produce these representations in an efficient way is inevitable. Further, the policy (DBE, 2011:10) states that in this phase, learners

> *should be exposed to mathematical experiences that give them many opportunities to develop their mathematical reasoning and creative skills in preparation for more abstract mathematics in Higher/ Tertiary Education institutions.*

In the overview of the topics, teachers are also guided into how they could engage multimodality in their use of texts. For example, from grade 10 – 12 the "relationship between variables in terms of numeral, graphical and symbolic representations of functions and convert flexibly between these representations (tables, graphs, words and formulae)". Reference is also made to technology in the grade 10 – 11 topics where teachers are advised to "generate as many graphs as necessary, initially by means of point-by-point plotting supported by technology" (DBE, 2011:12).

In the assessment section the policy emphasises modelling of the use of authentic examples in the construction of problems to be solved by learners in the tasks. There is for instance an example on probability where the word BAFANA is used in the context of the world cup. Usage of such local experiences as examples is therefore of pedagogical value as it is aligned to the curriculum prospects and helps learners learn how to deal with mathematics problems in the context of what they are familiar with. The policy also stresses the importance of regular feedback for both informal and formal assessment.

There is evidence that the mathematics curriculum makes explicit what pedagogical aspects need to be engaged in order for learners to be oriented into this complex language. Although there is no direct link to the use of ICTs, the content helps in making decisions on what affordances to look for in the digital media. The challenge though is that if links to the media are not provided, teachers are bound to stick to the non-digital technologies and miss out on the effectiveness and efficiency they can achieve through their utilisation.

The **Geography** curriculum stresses the importance of using visual text as a basis for dealing with complex topics in geography. For instance in the development of geographical content

understanding, teachers are advised to begin with observation followed by description in the methods of enquiry.
One of the aims for teaching the subject emphasises the importance of learning how to interpret geographical processes, describe and explain their interrelationship. This is not just interpreting complex symbols as in mathematics that the teacher should teach, but real objects or features that learners need to experience through eye or audio contact.

The other aim that is of interest to this study is "to promote the use of Information and Communication Technology (ICT) and Geographical Information Systems (GIS)" (DBE, 2011:8). This curriculum has made an effort to model its aim by providing teachers with at least one website for each topic to be covered. In the grade 12 topic, "Geomorphology", the document recommends up to 4 URLs, making it easier for teachers to identify meaningful and relevant resources. In fact, the GIS is included throughout the FET Phase as a teaching and learning resource.

Amongst the attitudes and values, teachers are expected to create environments where learners can apply "geographical knowledge and skills in learners' lives" (DBE, 2011:9). Pedagogical value is therefore in the teacher working from contexts that learners are familiar with.

A detailed content coverage is provided and the skills to be developed are stated. Amongst those, are "verbal quantitative and symbolic data forms such as text, pictures, graphs, tables, diagrams and maps" (DBE, 2011: 9) and all these call for the engagement of multimodality. Teachers also need to give learners opportunities where they can practise specific skills like working collaboratively and individually.

The designers of this subject policy have attempted to cater for classroom contexts with no access to the internet by suggesting the use of DVDs in addition to non-digital resources and this is commendable. The emphasis put on these resources indicate a need to stress on concretising geographical elements and processes that promote understanding and the development of concepts and thinking required in this subject.

In the **English (FAL) First Additional Language**, the policy acknowledges that learners reach the FET phase with inadequate skills for the level and it is for that reason that they need support. Therefore this document provides so much detail in its content in terms of what, how and when to teach the language skills. The policy sets the standard by declaring that learners should be able to

"acquire language skills necessary to communicate accurately and appropriately" (DBE, 2011: 9) in this second language in all aspects of their schooling life.

The processes that teachers should follow in order to develop each of the skills with their different genres is provided. Examples are given on how teachers can plan to teach the four language skills over a period of time. Included are resources based on types of texts that teachers and learners can use to develop and assess these skills. Four different language teaching approaches are presented with their descriptions and how each can help in the enhancement of language teaching. Although there is reference to digital technology usage in the reading and viewing skill, there is very little of its use in other aspects of teaching and learning the language at this level.

Although this document is very comprehensive in terms of giving teachers direction on what and how to teach it, given the extent to which teaching this language at this phase is a challenge, there is no explicit guidance to the teachers on how they can make best use of the digital technologies to promote enrichment and acceleration of the acquisition of the language skills.

Conclusion

Policy statements provide teachers with clear aims for teaching the subjects and provide comprehensive content coverage, especially in the English (FAL) together with guidelines on how to teach, what and how to assess it. However, indications on what ICT to use is generally absent or minimal except in geography where reference is given not just to the media, but the websites for specific topics. While this could be associated with the nature of the subject, this effort could be evidence that the policy has been updated to include modern available technologies. However, there are many free online resources that teachers can use to enhance the teaching and learning of their subject in cases where they have access to the internet. It is interesting though that the teacher who seems to be using ICTs extensively in this study is a mathematics teacher whose proficiency is a result of other factors that will be discussed in the next chapter. The White Paper on e-Education (2004) that will be discussed next gives guidelines on how teachers can utilise ICTs to the benefit of the achievement of these educational goals.

White Paper on e-Education

Having identified what seems to be of pedagogical value in the national curriculum goals and in the four subjects taught by teachers in this study, the gap between knowing how to teach content and how to utilise ICT affordances is suggested in this policy. This document is the South African ICT in Education policy and the foreword from the Minister of Education then, Professor Kader Asmal

proclaims its purpose as being an instrument to "establish the right conditions for ICT in education to flourish in the coming decades" (DoE, 2004:4).

This policy is also described in much detail in the literature review (Chapter 2) and only the key element relevant to this study will be raised from the tow chapters dealing with ICT pedagogical integration. Its second chapter defines what e-education means in the South African education context. It begins by establishing that e-Education "revolves around the use of ICT to accelerate the achievement of national educational goals" (DoE, 2004:15). The chapter then describes the educational benefits of using digital technology in the context of curriculum goals to improve quality and equity. The third chapter, 'The Use of ICT in Education' is closer to the interest of this study in the sense that it seems to give guidance on how teachers should integrate ICTs into their teaching.

While indications have been made in this policy of how ICTs can enhance pedagogy, what seems to be missing in the policy's articulation is that it is the teacher's prerogative to teach and develop thinking skills and not the mere presence of the technology. There is evidence that a policy of this nature should be consistently updated as new technologies become available to schools, otherwise it becomes irrelevant as a guide for its implementers. The next document draws attention to the skills teachers need to effectively utilise the ICTs available in their classrooms.

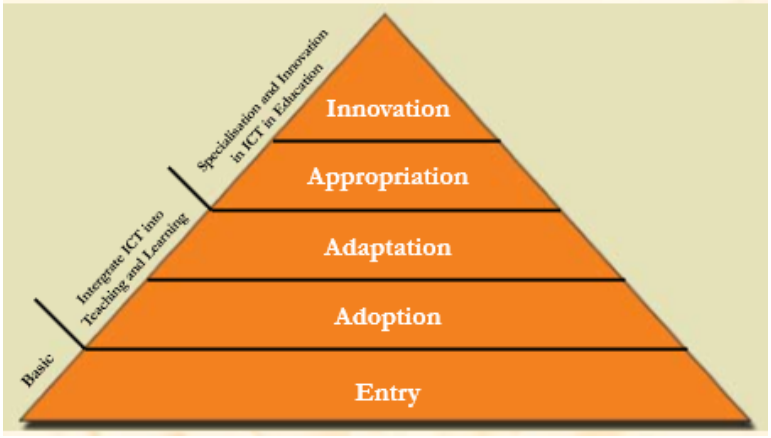
Guidelines for Teacher Training and Professional Development in ICT

This is the national framework for teacher development in ICT and is an extension of the White Paper on e-Education designed to give guidelines to ICT teacher trainers on what capabilities teachers need to have in order to implement the NCS or CAPS effectively through ICT use.

The policy emphasises the need to adopt a holistic approach adapted from the European Union's T3 Core Curriculum for Telematics in Teacher Training. This model incorporates 1) a pedagogical dimension where teachers are empowered to integrate ICTs into the curriculum; 2) a technical dimension which entails knowledge about ICTs and 3) engaging in collaborative activities within the practice of teaching (DoE, 2007:). The teachers in this study possess the second element in these capabilities, but they have not received any training on the first and yet they are currently apply it regularly in their practice. None of the teachers' responses indicates their participation in collaborative activities.

As the White Paper on e-Education (2004) asserts, this policy affirms that effective ICT integration can promote the achievement of the NCS goals. Its aim though is to "identify the ICT knowledge and skills that teachers require to integrate ICT into the curriculum to support curriculum delivery in specific contexts" (DoE, 2007:5). The Guidelines for Teacher Training and Professional Development in ICT (DoE, 2007) positions this study's teachers' attributes in the top four levels as they are all able to use digital technology to teach their subjects. According to the framework illustrated below,

Figure 6.1: The Teacher Development Framework



Guideline for Teacher Training and Professional Development in ICT (2007:7)

in the ICT Professional Aptitude section, the teacher should be " able to use various ICTs, including computers, to support traditional management, administration, teaching and learning, and is able to teach learners how to use ICT" (Adoption level); have knowledge, skills and values on ICTs that enable him/ her to adapt "teaching strategies in the light of his/her knowledge, understanding and experience of using ICT" (adaptation level); understand "the educational value and potential of ICT in teaching and learning" (appropriation level) and "create new and innovative uses for application programs in teaching and learning…" (Innovation level) (DoE, 2007:6).

This policy provides the ICT teacher trainer with steps to follow in their planning for appropriate training. The next document is context-based as it is designed to offer guidance to Gauteng public schools on how to manage and use ICTs for educational purposes.

Guidelines on the Management and Usage of ICTs in Public Schools in Gauteng

What makes this policy different from the other three policies is that it is designed for a specific context within the department of education and its advantage could be that local circumstances and potential unique to the province were taken into consideration in its development. McLaughlin (1987:172) supports this endeavour by saying, "policy success depends critically on two broad

factors: local capacity and will". In addition to provisioning of ICT equipment to its schools, this province has offered computer basic training to its teachers in order to equip them with skills they could use for educational purposes. Although this move was an expression of the province's will - that of empowering the school management and teachers, it still has a lot to be desired as there are a number of instances where computers have been reported as not being used and in some cases locked safely in storerooms. This policy is one of the province's interventions, to come up with structures that should help provide explicit directions on what schools need to do to support and implement ICT integration.

The 5 pages of this document are more relevant to this study and they attempt to draw attention to the core business of teaching with digital technology. The section on ICT usage in this document also emphasises learning through ICTs, a concept drawn from the White Paper on e-Education and in the Guidelines for Teacher Training and Professional Development in ICT.

These education policies have been designed so they can complement each other. The ICT in education policies in particular aim at giving directions on how the National Curriculum Statement goals can be achieved by different stakeholders through the use of digital technology. While the general aims provide what knowledge, skills and values teachers teaching learners at all levels of schooling should develop, the subject curricula seem to contribute immensely to the formation of teacher pedagogical beliefs which are reflected in teachers' actual teaching in this study. The ICT in Education policy, the White Paper on e-Education presents the distinctions between different levels of ICT usage in education and recommends the skills needed for the achievement of the NCS goals which are at high cognitive levels. The Guidelines for Teacher and Professional Development in ICT provides descriptions of teacher technological capabilities, and that could be the reason why many teacher training programmes focus on operational skills. Following is the analysis of what these policies seem to consider as of pedagogical value using this study's analytical framework.

Analysis of Pedagogical value in the use of ICTs in policies

The descriptions of the policies above highlight their contribution to the knowledge and skills teachers need to integrate ICTs into their teaching. The following analysis will try and align what policies advocate for with the pedagogical value as described in this study's analytical framework. For that reason, this study's analytical framework will be used to indicate where (in the frame) and which policy seems to provide teachers with indicators on how to go about using digital technology to supplement their teaching. The document numbering used in the framework for the policies is as follows:

Table 6.1: Numbering of policy documents

Document Name	Document Number
CAPS document	1
White Paper on e-Education	2
Guidelines for Teacher Training and Professional Development in ICT	3
Guidelines on the management and usage of ICTs in Public Schools in Gauteng	4

The document numbers and the pages where the relevant statement suggesting the table cell content have been used to allocate the policies in the appropriate column. The statements from the policies are indicated in italics in the second column on the table as evidence. The documents suggest desired teacher and learner behaviour and therefore instead of 'evidence' in the third row of the framework, 'content analysis' has been used to show that there is an indication in the policy content that relates to the framework feature concerned. In the affordances row, the policies, instead suggest the knowledge and skills that could be a guide to the affordance teachers can elicit from the ICTs.

Learners in this study generally do not use ICTs to learn. Their teachers are the only ones who use these digital technologies to teach. In other words, their benefit from the ICTs is through their teachers' usage. In the introduction of the analytical framework in Chapter 4 and its use in the previous chapter (Chapter 5), the context that the township teachers are working from is made explicit. It is for that reason that the policy framework's relationship with the teachers' practices ought to relate to their context or the same description of pedagogical value, where the teacher is the only user of technology. Therefore, this study will indicate where policies are aligned with this study's analytic framework and in addition to that, it will show with a red cross where its description clearly does not match that of the township teachers. Where the description is not explicit, in other words, it does not blatantly state whether the statement refers to learners or teachers, that may be highlighted, but will not be defined as referring to either as there will be no evidence. The overview on the analysis is given in the box on the right. The gaps identified in the policy framework will thereafter be identified and to conclude, the extent to which is relevant to this context for each media is offered.

Narrative media

Table 6.2: Policy analysis of the narrative media form

Media form: **Narrative**	
Affordances-Knowledge and skills	Nonlinear
	2:17 – *e-learning is flexible learning using ICT resources, tools and applications …*
Content Analysis	Multimodality
	1:5 – learners should be able to *communicate effectively using visual, symbolic and/ or language skills in various modes* ✖ 2:23 - *To promote understanding will be supplemented by multi-media applications* 3:10 - *use integrated features of applications including data analysis tools … and multimedia presentation programs* ✖
Pedagogical value	Content structure/ Connections
	1:4 – *acquire and apply knowledge and skills in ways that are meaningful to their own lives*

Policy framework overview
In its description of e-learning, the ICT in education policy acknowledges the nonlinearity in the flexible use of the different ICT tools to present the content structure. In the case of this study nonlinearity is at the level of the teacher as he tries to interpret the structure by engaging the conversation and different media forms (digital and non-digital) and teaching strategies. It is through the teacher's effective use of symbols in different forms that learners receive their interpretation. According to the CAPS documents, the pedagogical value would therefore be determined by whether the teacher's presentation of structure is meaningful, otherwise the academic knowledge as a tool is irrelevant to learners' every day experience (Laurillard, 2004).

The policies recorded seem to be aware of ICT capabilities in the narrative media and that it should be non-linear. However the 3rd document simply states that teachers should have these technical skills, but how these should be acquired or implemented remains implicit. The assumption seems to be that learners use ICTs or they learn through them. Learners who do not have access to digital technology are excluded in this case. The 4th document seems not to give guidance on the use of ICTs to present structure (as a narrative media form) in the classroom.

This is a characteristic that confirms that teachers in the Gauteng province have not been provided with clear guidelines on how they should integrate ICTs as indicated in the PanAf project (2008 – 2012) and this responsibility is left to the ICT teacher trainers who in this case have been offering basic computer skills. It is at local level that ICT pedagogical value should be made explicit so teachers can readily implement based on what the authority in their context recommends. Although the other policies analysed state the aspects needed to help make ICT use of pedagogical value, the detail of how they go about it in the classroom remains at a principle and indicator level. It therefore takes a teacher who is innovative to critically interpret these implications if the implementation of ICT integration into subject teaching will bring value.

Although the policies have the same views as that in the analytical framework, based on the fact that all of them, particularly the first and the third do not indicate how learners with no access to ICTs

can benefit through their teacher use as a narrative media form make them inadequate for the context of this study.

Interactive media

Table 6.3: Policy analysis of the interactive media form

Media form: **Interactive**	
Affordances – Knowledge and skills	Immediacy
	2:15– *accelerate achievement of national education goals*
Content analysis	Immediate feedback
	2:24 - *Teachers will also be able to give learners immediate feedback on progress*
Pedagogical value	Exploring: Misconceptions amended
	2:24 – *identify areas of weakness and design necessary and appropriate support systems in a timely fashion*

Policy framework overview
When ICTs are considered to having characteristics of accelerating the achievement of goals that has connotations on them having capabilities to quicken the learning process. That can come as a result of the technology presenting desired content timeously or enabling an efficient assimilation process, giving way to accomplishment of more curriculum goals. In addition, this policy highlights the ability of teachers to give learners immediate feedback. Automated assessment can be used for this purpose in formative assessment where learners can get intrinsic feedback that they can use to amend their misconceptions. In a case where clickers are used for instance, pedagogical value can be gained when teachers are able to receive instant feedback on learner performance and so be able to prepare for interventions. The same effect can be achieved when the teachers are the only users of technology through conversation which is not included in this policy.

The only document that is recorded here seems to be giving direct guidance to teachers. There is also an indication of how they can go about engaging media so there is pedagogical value in their usage. However the interaction as described is ambiguous in the sense that it is left to the teacher to figure out what to do with this immediate feedback. This could be included in the 3rd and 4th documents to give guidance on how to integrate digital technology into their actual teaching. The acceleration of goals through ICTs needs to be elaborated as misinterpretation of this idea could lead to information overload and other undesirable consequences. The knowledge as is provided in the ICT in education policy is not enough.

The strength of the policy frame is in that the teacher is addressed, but the subordinate documents do not take that up to further explain how teachers can teach ‘with’ ICTs to supplement their teaching. This could be the reason why teachers participating in this province seem not to utilise this media at the level of description offered in the policy.

Communicative media

Table 6.4: Policy analysis of the communicative media form

Media form: **Communication**	
Affordances – Knowledge and skills	Collaboration
	2:23 – *means of communicating and collaborating with other learners and teachers* ✖ 3:11 – *facilitate interaction between learners through the use of email and the Internet* ✖ 4:21 – *use ICT as a flexible tool, so that learning becomes collaborative and interactive*
Content analysis	Discussion: Class/ Group
	1:5 - *work effectively as individuals and with others as members of a team* 3:11 – *create and facilitate online discussion groups and virtual communities* ✖
Pedagogical value	Re-descriptions- misconceptions
	1:5 - *as above* 2:23 – *as above* 3:11 – *as above*

Policy framework overview
The 2nd and the 3rd documents consider the use of ICTs for collaboration at operational level where learners interact online and teachers have the ability to facilitate these discussions to promote learning. On the other hand, the 4th document seems to accommodate the conversation and that the flexible use of ICTs can actually promote collaboration and interactivity. In this case collaboration is not necessarily online but could be through any media. This approach aligns with the way teachers in this study engaged this media in the different ways teachers use the digital technology. As much as collaboration can be of benefit to the learning process, the CAPS document introduces the social aspect of the benefit which should be developed through pedagogical activity. Working in a team, entails working towards a goal and as members contribute to the task, they help each other by identifying misconceptions that are detrimental to the achievement of the goal and offer re-descriptions that help accomplish the group task.

The CAPS document in this case seems to offer the ultimate outcome of engaging learners in collaborative activities. The ICT in Education policy and the Guidelines for Teacher Training focus on the skills and technical aspects of the communicative form. The 2nd and the 3rd documents seems to assume that learners have access to technology for the purpose of communication which is not the case with any of the classrooms in this study. The Gauteng province's document seems to relate closely to the use of ICTs by the teachers in this study The type of usage promotes collaboration as teachers interact with their learners as they develop concept understanding. In this case, pedagogical value is in the ICT creating an environment that promotes collaboration that plays a role in the learners participating in their learning.

The policies are generally not relevant to the conditions of classrooms in the township as they do not relate to the communication styles that the teachers and learners engage in as a result of the teacher teaching with computers. Alternatives could be given of other ways of communicating to cater for the majority of classrooms or circumstances in this country rather than focus on this description of learning through ICTs that does not relate to most circumstances where there are limited resources.

Adaptive media

Table 6.5: Policy analysis of the adaptive media form

Media form: **Adaptive**	
Affordances – Knowledge and skills	Diversity
	1:4 – *equipping learners, irrespective of their socio-economic background, race, gender, physical ability or intellectual ability, with the knowledge, skills and values necessary for self-fulfilment and meaningful participation in society as citizens of a free country* 2:24 – *access to a variety of learning and teaching support material that promotes the appreciation of diversity, a collective identity across the school and begins to connect schools to the broader societal goals* 3:14 – *is aware of and plans for both diversity and uniqueness of learners (inclusive education) through the use of ICT in learning*
Content analysis	Reproduction: experiment/ role play
	3:12 – *use interactive, subject-specific software that encourages simulation, experimental enquiry, decision making, etc.* 1:5 – *Inclusivity should become a central part of the organisation, planning and teaching at each school*
Pedagogical value	Concretising theory
	2:23 – *access to a variety of learning and teaching support material that promotes the appreciation of diversity…*

Policy framework overview
The first 3 policies seem to emphasise the adaptive media form. The curriculum acknowledges the importance of catering for diversity in educating learners. ICTs are therefore considered by the 2nd and 3rd policies to be integral in catering for learner learning differences. Their affordances are valued for their ability to provide learners with experiences that can make learning of academic knowledge accessible as the different media forms, modal texts and learning environments are created through ICTs. Pedagogical value therefore is in the teacher's ability to engage ICTs in such a way that learners are able to relate to new knowledge through the teacher's use of digital technology as in the case of some teachers in this study. The teachers use different teaching methods and media to achieve this educational goal. Learners are able to concretise theory by what the teacher exposes them to through conversation and the infusion of ICTs.

Diversity seems to be the drive for integrating ICTs in the first three policies and there seems to be more presented in them that address this issue. It is the ability of ICT affordances to provide learners with real-world experiences as they try and adapt to theory that make their use of pedagogical value. However, an integration of aspects of classroom conversation contributes to the creation and effectiveness of these experiences. The Gauteng document seems to be silent on this aspect and yet this could have been a platform for the province to closely deal with their distinct contextual issues and how the teachers' and learners' use of ICTs could help alleviate them. Pedagogical value though is not as explicit as it should be. Teachers need to know how the engagement of this media can benefit their learners before they engage with other teachers to share ideas to avoid the habit of consuming or taking ideas that do not relate to their classroom situations.

There is a strong relationship of what policies advocate with what teachers in township schools seem to value based on their circumstances. The descriptions are mainly directed to teachers and although that is commendable, teachers still need ideas on how they can best utilise the media to gain pedagogical value.

Productive media

Table 6.6: Policy analysis of the productive media form

Media form: **Productive**	
Affordances – Knowledge and skills	Articulation
	2:23 – *opportunities of creating and presenting new knowledge* 3:12 – *use a range of information resources to construct knowledge* 4:20 - *using a word processing package as the medium for delivering a piece of creative writing* ✖
Content analysis	Product: animation/ model
	2.17 – *offers opportunities for higher-order thinking and creativity in processing, constructing and conveying knowledge* ✖
Pedagogical value	Knowledge construction
	1:5 – *identify and solve problems and make decisions using critical and creative thinking* 2:23 - *As above* 3:12 - *use ICT for knowledge – building strategies rather than for information transfer only*

Policy framework overview
Opportunities for using this media form by the first three policies seem to be associated with higher levels of thinking. Usage by the 4th document is at learner level and as a mere productive tool. Pedagogical value is not stated by the document. At this stage learners have acquired academic knowledge and are able to draw from the different concepts and experiences to solve problems by constructing new knowledge. ICTs are therefore used to create and present the product.

It seems the 2nd, 3rd and 4th documents value ICTs for their ability to create and present new knowledge through the use of ICTs. In the case of the 4th document, the engagement of the media could be at the level of production and not in developing or creating knowledge. The idea of creating knowledge with ICTs needs explanation as its misinterpretation can lead to low levels of this media form out of ignorance. The CAPS document seems to make clear what the outcome of the experience should be. The supporting documents are not really explicit on how this can be done with ICTs. However, the knowledge construction does not necessarily have to be carried out through digital technology and yet its affordances can contribute to preparing learners with skills they would need to produce new knowledge. That is what is happening with the teachers in this study.

The assumption by the 2nd and the 4th documents is that learners are users of ICTs and that they engage them to develop higher order thinking skills through them is not relevant to most township schools. However it is the mathematics teachers who seem to be concerned about developing learners skills through their integration of ICTs into their teaching. The rest of the policies do not specify, leaving it open for teachers to integrate other technologies and teaching strategies to achieve their teaching and learning goals.

Summary

The four documents provide an account of what is of value in the teaching, learning process and in the creation of learning environments that promote achievement of curriculum goals. The following table indicates which policies relate to the pedagogical value in Laurillard's (2002) media forms.

Table 6.7: Summary of document relevance to the media forms

Media form	Document 1	Document 2	Document 3	Document 4
Narrative	√	√	√	x
Interactive	x	√	x	x
Communicative	√	√	√	√
Adaptive	√	√	√	x
Productive	√	√	√	√

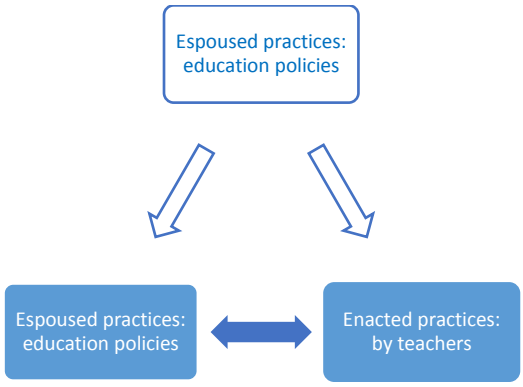
The second document seems to cover all the media forms and as already been indicated, the level at which this policy has pitched its descriptions does not seem to relate to relate or make explicit how teachers, particularly those in classrooms with limited resources can achieve the same goals with what they have. Emphasis need not be placed too much on the technology, but on the actual teaching and how ICTs can enhance it. The 3rd and 1st documents do not relate to the interactive media and that could be understandable with the 1st as the media provides detail on how the curriculum goals can be achieved. The 3rd document should be giving that detail in this media as it should be as extension of the 2nd document. The 4th document of all documents does not address the issue of pedagogical to teachers and this is because of its focus on technical abilities that do not relate directly to the actual teaching with ICTs and its benefits. The policy should have made an effort to bring ICT into integration into the classroom by giving informed detail that can guide Gauteng teachers in explicit ways that they can relate to in their circumstances.

Conclusion

Having pointed out what is distinct about each document, particularly what the context of this study would have valued in their guidance in the integration of ICTs, this study finds the policy framework strong in the articulation of what is of value in the pedagogical integration of ICTs. The ICT in education policy for instance has captured all media forms and as the main guide on the effective implementation of digital technology it needs supplementary policies that can broaden particularly its interpretation so teachers from a wide range of contexts are able to relate to it. This therefore leads to the policy framework weakness. The inability of the policies to provide customised guidance for the ordinary South African classroom compromise issues of equity and deems its implementation implausible for the majority of its institutions as they have limited digital resources.

Coherence between policy documents (espoused view) and teachers' espoused views

In this section, Laurillard's (2002) media forms are used to make explicit the coherence between the policy and the teacher beliefs as illustrated in the figure below adapted from Figure 1.8 in Chapter 1. That will help check if teachers' espoused practices are informed by the policies - which is the ideal. The policies at this stage are dealt with as a single body that serves the purpose of guiding South African teachers on what ought to be considered as of pedagogical value in the use of ICTs for teaching their subjects.



The policies capture the five media forms used in the analytic framework of this study and yet based on the data presentation in Chapter 5, there are variations in the teacher espoused practices. For instance, it is only the 2 mathematics teachers who seemed to use all the media forms as presented in their responses to the interviews and even then their engagement of these forms was different. The South African policies generally seem to assume learners have access to technology and thus they have the same descriptions as those developed from the media forms and affordances from Laurillard (2002) and Conole and Dyke (2004) that contribute to this study's analytical framework.

In the narrative media form, all teachers except one believe the ICT pedagogical value is derived from the multimodality that comes with the engagement of different texts and media afforded by digital technology. This characteristic as in the policies is perceived as a catalyst for better understanding of new concepts by the teachers. The teacher who seemed not to engage the affordances of this media form had a different conception of what ICT pedagogical integration is. For him, the concept referred to learners learning through ICTs in an online learning environment.

This could be the reason why he seemed to expect digital technology to have the same effect in a conventional classroom. This is a misconception and it is not aligned with the policy framework. He also seemed to engage the digital technology in a linear way as he presented notes. Other modal texts were not mentioned. Considering that this teacher has majored in e-Learning in a local university, it is possible that his belief is influenced by the learning experiences he had that institution more so that he has not attended any other ICT teacher training program. The rest of the teachers seemed to believe their presentation of lessons with ICTs had pedagogical value they gained through their use of images or visuals in particular.

The interactive media form in the policies is associated with accelerated achievement of curriculum goals and it is probably its immediacy affordance in giving learners immediate feedback which can be used to direct development in learning. Immediacy is interpreted differently by teachers in this study. For instance, the description of two (mathematics) teachers out of the 7 teachers is aligned with the policy; three associate it with making it possible to cover more content; two associate it with mere quick feedback from learners which is not linked to learning. Pedagogic value is bound to vary as is the case with these teachers. Although there is nothing wrong with interpreting policy statements differently as long as the same educational goal is achieved, the problem comes when it is ill-informed and results in undesirable outcomes where the learning process is inhibited. The best teacher in this study seemed to be the only one who knew how to utilise his learners' feedback from the technology to develop learning activities that addressed identified weaknesses as follow up. His strategies were aligned with the policy framework although in his case ICTs were integrated into the normal learning activities. This brought pedagogical value to his teaching.

In the communicative media form, the policies applaud ICTs for creating learning platforms for collaboration. The details as in the other media forms are not given on how to achieve effectiveness in these experiences in the policies. Only two (mathematics) teachers in this study claim to engage this media form. One teacher uses it for class debates and group discussions while the other teacher uses it for class debates only. It is possible that the other teachers do not incorporate this media form in their teaching because they do not see its space in their integration of ICTs. The other reason could be that the impression given in the policies is that the communication should be through the use of ICTs. The view cannot be linked to their computer skills as the other mathematics teacher only has basic skills while the other one is a computer programmer. Although the mathematics teachers believe they engage this media form, in addition to the ICT as a stimulus for the learning activity, they use speech as medium and group work or debates as a teaching strategy. It is evident that this media form would directly benefit learners if they used them during the learning process.

All teachers except one seem to believe the use of ICTs as an adaptive media form is instrumental in catering for diversity. The policy alludes to this view as it highlights its usefulness in providing different learning environments for specific learners. The mathematics and physical science teachers mentioned pedagogical value in terms of subject specific benefits in helping learners concretise theory. Although this is aligned to policy imperatives, some of the responses indicated uncertainty when deeper understandings on the pedagogical value were elicited. It is possible that much as the teachers might have known what the policy claims are, they had not developed insights into how these could be applied. This shows how inadequate policy statements can lead to shallow understandings about integration issues.

The policies seem to value the productive media for developing learner higher – order thinking skills learners need to solve problems and for construction and presentation of knowledge by learners. In the case of the only two (mathematics) teachers who seemed to engage the productive media form in their espoused practice, their purpose was to help learners develop desired subject thinking skills. It is only the programmer that gives his learners an opportunity to present with both the non-digital and the digital production media. The other mathematics teacher seems to rely on exercise books as productive media. Both these experiences are not indicated in the policy and yet they are able to accomplish the same pedagogical value as that suggested in the policy framework.

Conclusion

This study does not find the policy framework to be completely adequate as a workable account of ICT integration for the context that this study is operating from based on reasons ranging from teacher attributes, diverse interpretations of the policy assertions and access to digital resources.

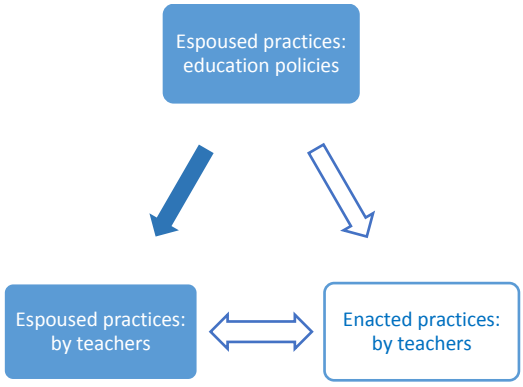
The narrative and the adaptive media form in the policies seem to be coherent with teacher's espoused practices except for one teacher whose value seems to be more inclined to technical benefits. The productive media as described in the policies offer more affordances which are developing thinking skills, create knowledge and presentation of knowledge. Although the programmer can create knowledge with the different ICTs, he seems not to be giving that opportunity to his learners, given that there is one technology in the classroom. It is for that reason that this study finds the policy framework not helpful for teachers teaching in classrooms with limited resources. In the communicative media, the policy seems to imply use by learners online and the other perspective states that ICT use is to promote collaboration. This can be interpreted as meaning online or that its use by the teacher encourages collaboration through classroom conversation. The two teachers engaging this media form seem to be the ones who indicate practical

ways of carrying out the collaboration through class or group work as evidence in this study's analytical framework which relates to that of Laurillard (2002), but offline. Whichever way can bring the same pedagogical benefits, depending on the circumstances anywhere. There is variety in the interpretation of the interactive media. The fact that ICT use has the benefit of accelerating curriculum goals is interpreted as literally covering more content by three of the seven teachers.

The policy framework does not suggest other media forms that could be used in the act accomplishing the pedagogical value with the media forms by so doing making its compliance for only those with adequate digital resources. The fact that the policies lack detail on the practicality of how to implement its imperatives, different interpretations arise, leading to diverse implementation of the policies as is demonstrated in the next section.

Coherence between policy and enacted teacher practice

In this section this study will discuss the relationship between policy and enacted practice as illustrated in the following figure adapted from Figure 1.8 in Chapter 1.



The teachers' enacted practices seem to display more incoherencies and could be a result of existing mismatches with the espoused practices. The other reason could be that this time non-digital and teaching methods came to the fore in the actual teaching which had not been mentioned in the espoused practices and in some cases it replaced the ICTs in the media forms teachers had claimed they engaged.

In the narrative media form, only three teachers engaged different modal texts and media during their teaching. None of these teachers relied on digital modality but integrated all that seemed to be handy at the moment of the explanation in terms of teaching methods, strategies and non-digital

technologies. This kind of usage probably resonates with that of the policy framework which advocates for flexibility and meaningful ways of understanding. Meaning seemed to be brought about by the non-linearity as the different modes and teaching strategies were used in the flow of the classroom conversation. It is probably this practicality that teachers need to be made aware of in the policies. The fourth teacher did not use the ICT as a narrative form but a display platform in the background, which is referenced to (only 4 times in the hour long classroom conversation) whenever it is needed in the conversation. Three of the remaining teachers use a linear teaching approach in their use of the ICT and have only used written text in their teaching material which they use to present a rather inflexible structural. What seems to be lacking in their conversations is meaningful feedback from the learners that Laurillard (2004) believes should lead to shared understandings, which is not explicit in this case. In the cases where teacher enacted practices no longer related to the policy framework, it seems, teachers were in their normal mode of operation which seemed to link with the impression they gage in the interviews as demonstrated in the next chapter (Chapter 7). It seems the knowledge of policy imperatives disappeared as they reduced the ICT pedagogical value they had assigned to their use of digital technology. In most of these cases, classroom conversation dominated to the extent of insignificance over the ICT and this behaviour is not policy aligned.

The first three teachers, whose actual practice aligns with the policy framework, complied in the interactive media form as well. Their compliance is at different levels though and this seems to depend on their subject needs and their proficiency in computer skills. All teachers apparently engage the immediacy affordance, but their interpretation of acceleration of curriculum goals as the polies advocate varies. One teacher seemed to value ICT immediacy for its ability to cover much content and this was at the expense of learner understanding as they struggled to grasp the concepts taught. The other teacher did not intervene after receiving feedback from learners and seemed to hope the feedback from the technology was adequate and yet policy advocates that it should be used to advance learning. The last two teachers relied more on verbal immediacy. It seems whenever there was no external demonstration as recommended by Laurillard (2002) of feedback from the teacher or the learner, it became difficult to establish value, especially if amendment of misconceptions were not visible.

All teachers seem to engage the communicative media and in all cases the role the digital technology plays is to initiate collaboration. Collaboration is not through the ICT but is prompted by the way it is used. The policy framework partly advocates for flexible ICT use that will promote collaboration in addition operating through the medium. It is not so clear what that means, for instance, does the

flexibility refer to promoting collaboration while working with the digital media or it means incorporating it with other media. However, what is of pedagogical value is that it says it must be used to learn. Learners seemed to be engaged productively in the class learning activity guided by the teachers as they participated in the interaction that was taking place. Therefore, where there was evidence that learning was taking place through the communication which ever media was used, is coherent with the policy. The level of learner engagement and purpose seemed to vary though.

In the adaptive media, the policy framework promotes recognition of diversity in the learning activity. Laurillard's (2002) Conversational Framework creates an environment where individuality in grasping concepts can be catered for as the teacher or the mediator opens spaces for the interaction. In addition to that, Laurillard (2002) emphasises that because academic knowledge involves descriptions about the world, it is not easy to apprehend it. Engagement of a variety of resources as the policy suggests can assist in making abstract forms of knowledge concrete, thereby making it accessible. Four teachers in this study engage the adaptive form and use visual images, non- digital resources and various ICT affordances to try and help learners experience theory. In some cases, ICTs were used to orient learners into the subject ways of thinking. In such cases, enacted practice is coherent with the policy framework. One of the remaining teachers engage the adaptive media form through the conversation and in particular used non-digital media only. The other two did not engage it at all and this could be related to the linearity in their use of ICT as they both used written text only. Such use is not aligned with the policy. The integration approach seems to be of influence in the engagement of this media form.

The learners of the only (mathematics) teacher in this study who engages the productive media form use it in groups to articulate themselves as they work out tasks they have been given in their exercise books. Although the ICT is not directly used by learners, the teacher engages it to extend learner understanding whenever they ask for assistance. It would not be possible to comply with the policy in this case because learners do not have access to digital resources. Therefore the policy's assumption that learners can develop skills needed for knowledge construction through ICT use does not relate to the circumstances these teachers are working in.

There seems to be more inconsistencies in the relationship between enacted teachers' practice and the policy framework. Lack of learner access to the technology could be the main cause of the irregularities, but there seems to be a stronger impact from the teaching approach used by the teacher. Where ICTs were made to dominate at the expense of teaching for instance, their use

seemed to be of lesser pedagogical value and more strayed from the policy imperatives about ICT integration.

On the other hand, Fengu and Krauss (2012:03) believe, "When a powerful technology is introduced into an organisation or a society, it does not leave the organisation or society unaffected; more so in a context that openly embraces ideas not belonging to it". It is therefore possible for teachers to have teaching philosophies or curriculum interpretations that are contrary to predictions. Du Plooy and Roode in Fengu and Krauss (2012) support this view by suggesting that information technology is bound to promote decision in usage that compromise people's values. In order to preserve local ideologies, Fengu and Krauss (2012:07) argue that an "inside-out approach to ICT4D projects is taken as opposed to an all-encompassing 'blanket' approach". There is therefore potential in learning from the participating teachers as they seem to have applied this principle in their implementation of ICT pedagogical integration, more so that they see its value in the contexts they operate from.

Chapter conclusion

While the policy framework is coherent with Laurillard's (2002) description of the pedagogical benefits of media forms, it seems to operate from the same context in the sense that it assumes learners have access to digital technology when in actual fact, they do not in the context of this study. That brings a different dimension in the way the media forms are used in the classrooms to achieve the same pedagogical goals. The concept of integration appears to go beyond infusion of ICTs but extends to the integration of teachers' repertoire of pedagogical resources, including digital resources. It is also evident from this analysis that the relationship between the three data sets is complex and yet there are emerging features that should help understand and learn from these teachers what is of pedagogical value in the use of ICTs in classrooms with limited resources. The next chapter discusses these features.

The table below summarises the main findings in this chapter.

Table 6.8: Main conclusions about the findings

Media form	Data	Effective use	Not Effective use
Narrative Policy: multimodality	Espoused	Engagement of multimodality - for pedagogic purposes.	Use of digital text for non-pedagogic purposes.
	Enacted	Non-linear – multimodality - interpretations for representations.	Linear - Mono-modality/ use of images with no interpretation.
Interactive Policy: immediacy – to accelerate achievement of curriculum goals	Espoused	Accelerate curriculum goals through use of ICTs and immediate access to content. Ability to describe how learner feedback from ICT can be used for learning.	Immediacy- more content covered.
	Enacted	Learner feedback determines the pace and direction of the lesson. ICT used to instantly enrich classroom conversation.	Immediacy – more content covered with little feedback from learners. Not integrating ICTs into the classroom conversation.
Communicative Policy: using ICT to collaborate	Espoused	Collaboration of learners through speech as medium. ICT used to determine formation of groups	ICT not acknowledged as a medium that can enhance communication in the classroom.
	Enacted	ICT used to initiate classroom conversations in the discursive (introduction of lesson) and adaptive stage (group work) of the lesson in the CF.	Not integrating ICT into the classroom conversation.
Adaptive Policy: individualisation of learning	Espoused	ICTs make explicit abstract knowledge.	Detaching ICT value from the learning process.
	Enacted	Integration of ICT with classroom conversation to help concretise theory to support re-descriptions by learner and teacher.	ICT not engaged to support building of knowledge.
Productive Policy: knowledge presentation and construction through ICT use	Espoused	Learner ICT use develops subject thinking skills as learners present and discuss their understanding of concepts taught.	ICT use not promoting construction of knowledge.
	Enacted	ICT used by learners to demonstrate and justify or defend understandings in class – helps develop HOTS. During lesson ICT used as a model for concept presentation.	ICT use that does not promote generation of knowledge and understandings.

Chapter 7

Discussion

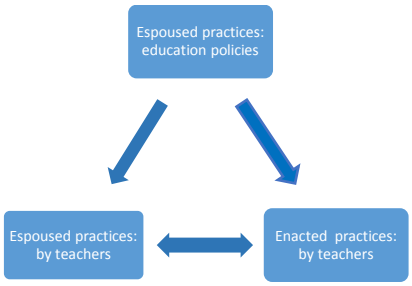


Introduction

In this chapter, the interpretation of teacher espoused, enacted and policy documents in this study is discussed in order to identify features that can help describe the pedagogical value that ICTs can bring in any South African classroom. The reason why this research is interested in a generic framework is because generally there is a gap between policy and implementation at classroom level (Vandeyar, 2015). The set standards in terms of access and utilisation of ICTs seem not to relate to most South African classrooms. Learners largely do not have direct access to digital technology in their classrooms and where there is availability in the classroom, it is for the teacher. However, learners can benefit from their teachers' effective use of ICTs which this study attempts to disclose through its examination of the relationship between teachers' espoused, enacted practices and how these relate to the policy framework.
The research question for this study is:

What is of pedagogical value in the classroom practices of seven South African secondary school teachers with ICTs?

The figure below has been presented in Figure 1.8 in Chapter 1. It illustrates how this chapter will identify emerging features that seem to be significant in establishing what is of pedagogical value in the teachers' use of ICTs that can contribute to the development of an ICT teacher training framework.



As already been indicated in the conceptual framework, the theoretical lens adopted in this study is based on Laurillard's Conversational Framework, developed from constructivists' principles. The teacher is the mediator of learning and the learner should be actively involved in his or her learning. It is on this basis that the engagement with data analyses in chapter 5 and 6 centred. In other words, it is important for this study to give evidence for pedagogical value based on what each teacher does as a mediator between academic knowledge and the learners. Laurillard's (2002) Conversational Framework has made it possible to see the roles played by both the teacher and the learner that can be used to determine the effectiveness of the learning activity. Her media forms are categorised in such a way that pedagogical value in their use can be identified and described through the use of ICT affordances (Conole and Dyke, 2004). It is language from these concepts that is used to capture what is of pedagogical value in classroom teachers' practices. In each case study, this study seeks to understand how

- the structure of the lesson is presented through the narrative media form;
- how the teacher and learners interact as the learning develops;
- how learners are involved in their learning in the communicative media form;
- how the teacher uses the adaptive media form to build or extend their understanding as they receive intrinsic feedback; and
- how learners are prepared for knowledge construction where applicable.

This being a multi-case study, each teacher practice as a case will now be closely examined in the context of espoused, enacted and the policy framework. In the previous chapter (Chapter 6), it has been established that the policy framework is not adequate as a workable account of ICT integration in the context of this study, not because it is inefficient, but for the reason that most of its descriptions assume learners have access to ICTs which is not the case with township schools participating in this study. Although its content plays its role of setting a standard, the lack of adequate resources in the majority of South African classrooms might make potential ICT users fail

to identify with it. It is possible that while the policy has these high expectations, the reality of the gap between its implementation and the circumstances teachers work in become a barrier in making the process feasible. While the policy has good intentions, emphasis should not be placed on the quality or quantity of resources but what teachers are able to do with the tools in order to bring pedagogical value to their classroom practices. As each case is examined, it is related to the South African policy framework for alignment.

Examination of each teacher practice case

What this study considers to be the teacher's statement that describes the role of ICT that seems to be of influence to the teacher's practice is followed by a summary of each case in the context of the analytical framework. It is possible that this statement embodies the teacher's ICT pedagogical beliefs that E
rtmer et al (2012) claim can be of influence to the teacher's enacted practice. Thereafter a discussion of what the summary means and how it relates to the policy framework will follow.

Key for reading each teacher summary table:

(T): ICT used	(NT): No ICT used
(NDT): Non-digital technology used	None: No media form
(NA): Not aligned with policy	(A): Aligned to the policy



Mshini

Role of ICT teacher statement: *trying to maybe do things that you would not be able to do*

The understanding of the role ICTs play tends to be associated with a concept of the function of machines. Machines do what human beings cannot do in terms of quantity and quality in the production process. This can be related to the ICT immediacy affordance where as he stated in his espoused practice, he is able to cover more content. The policy commends digital technology usage for facilitating the acceleration of curriculum goals. Although this study did not identify anywhere in the policies where the acceleration refers to covering more content, this can be interpreted to mean that. However, the use of ICTs and its mechanical affordances that promote acceleration of meaning making can be beneficial in the completion of the syllabus on time. This is not given, though.

Table7.1: Summary of Mshini's classroom practice

Media Form	Espoused	Enacted (CF – Adaptive)	Policy: Practice aligned
Narrative	Structure: multimodality, nonlinear (T)	Structure: multimodality, nonlinear – (NDT)	Espoused (A) Enacted (NA)
Interactive	Misconceptions amended: Immediacy – covering more content (T)	Misconceptions amended: Immediate feedback (NDT)	Espoused (A) Enacted (NA)
Communicative	None	Re-descriptions (NDT): class discussion (NDT)	Espoused (None) Enacted (NA)
Adaptive	Concretising theory: materials adapted (T)	Concretising theory (NDT): practice (NDT)	Espoused (A) Enacted (NA)
Productive	None	None	(None)
Coherence	Incoherent		Espoused (A) Enacted (NA)

The table above shows how inconsistent the espoused and enacted practices are. This may appear to be contrary to Ertmer et al. (2012) assertion that teacher pedagogical beliefs influence actual teaching and yet it is not so, based on the ICT role he assigns to digital technology. However, if his understanding of ICTs is linked with machine affordances, he would not need them in his enacted practice especially if he can cope with non-digital technology. This study finds his use to display questions not of pedagogical value in the sense that it enhances teaching and learning. In other words, cognitive engagement in this case cannot be associated with the ICT use. This teacher's perception of ICTs could be associated with that of the pre-service teachers in So and Kim's (2009) study that considered it as a mere delivery tool and not one that can support cognitive activities. It probably would if pedagogical immediacy were to be incorporated in this investigation, but still, its use is not distinct to ICT capability. Paper as handouts could have been used or any display platform for that matter. On the other hand, the fact that the teacher does not engage digital technology as evidence for pedagogical value does not make him an inefficient teacher, but says something about his integration which seems to be influenced by his perception of ICT use in the classroom.

In the adaptive media, there is no indication that the teacher has adapted any materials as he has indicated in his espoused practice. Instead he projects a word document with questions which could have been retrieved from the department of education website past examination web page. Again the teacher might not have found it necessary, based on the nature of the lesson to adapt material to other modal texts.

Communicative media is captured in the enacted practice and the class discussions do not engage ICT as such because reference is only made to it when the relevant question is needed. Thereafter, the classroom conversation carries on in its absence. In other words, what happens thereafter is a conventional learning environment which engages different teaching methods and resources.

To some extent, Mshini's espoused practice relates to the policy framework where ICT use is concerned. One reason for this coalition could be his awareness brought about by his experience or what he has seen friends (he learns from) accomplish with ICTs or what he has heard sponsors of its use say. There is also a possibility that this could be his pedagogical belief because although in the enacted practice he does not use ICTs to teach, his teaching approach in the narrative replicates his espoused teaching approach with ICTs. The difference is that he now uses non-digital technology instead. The implication could also be that he is more comfortable working with non-digital technology, and he has only used ICT for a year after all.

The conversation does not feature much in the espoused practice and yet in the enacted practice it dominates, over the role ICTs play. His teaching ignores the digital technology completely and only engages it when reference to its affordance (display of content) is needed, which occurs four times in an hour's lesson. While this can be associated with the fact that the 'machine' is probably not needed in this activity, particularly bearing in mind that the teacher can manage without it, this could mean that the conversation is in fact valued as a teaching act. While this is good, elevating the ICT role to contributing to the development of learner cognitive skills would then as Laurillard (2002) suggests, enhance the classroom dialogue.

Conclusion

Mshini's espoused practice is aligned to the policy framework and yet his enacted is not. While his alignment to the policy could be evidence that it contributes to the formation of his perceptions about ICT use for teaching that does not translate to enactment. Hammond (2009:216) argues that although affordances are "shaped by past experiences and context, may be conceptually sophisticated and may need to be signposted by peers and teachers". In the case of Mshini, his awareness of the affordances ICTs have, it is also important to know how the properties can be "exploited in particular learning and teaching contexts" (Conole and Dyke, 2004) beyond displaying content as he does. Furthermore, the fact that his enacted practice is not aligned to policy confirms the gap between policy and implementation which can be linked to inadequate support from province and district e-learning officials (Vandeyar, 2015). The other reason could be Mshini's understanding of what ICT pedagogical integration entails. As a teaching tool that does what the teacher cannot do, the teacher automatically disengages the technology from the collective role of making learning possible (Dron, 2012 and Laurillard, 2002).



Sizakele

ICT role teacher statement: *…convenient, cause it saves my time. Learners are able to answer questions that are complex. They are able to like do it quicker and faster.*

When Sizakele describes the ICT role as of convenience that means it is for improving efficiency. The school timetable is designed in a way that the teacher moves from class to class and writing notes for his classes becomes cumbersome and therefore the mobility of the ICTs he uses (laptop and projector) makes it convenient for him. Time is also saved because the immediacy of the technology gives him access to content structure instantly. The other statements which were in response to the benefits of ICTs to learners give the impression that digital technology has affordances that develop learner thinking abilities. This statement could also imply that the immediate response from the computer makes it possible for learners to answer complex questions and to respond to them instantaneously. This view is based on the learner using the technology which is not the case with this teacher anywhere.

Table 7.2: Summary of Sizakele's classroom practice

Media Form	Espoused	Enacted	Policy: Practice aligned
Narrative	Structure: Linear, mono-modality – notes (T)	Structure: mono-modality – linear (T)	Espoused (NA) Enacted (NA)
Interactive	Misconceptions amended: Immediacy – quick feedback from learners + convenience (T)	Misconceptions from feedback amended (NT): Immediacy – much content covered (T);	Espoused: (NA) Enacted: (NA)
Communicative	None	None	None
Adaptive	None	None	None
Productive	None	None	None
Coherence	Coherent		Enacted (NA) Espoused (NA)

The way he describes his engagement of the narrative form is coherent with the enacted practice and yet in each case, Sizakele's practice does not relate to the Conversational Framework. What seems to be the problem as learners struggle to follow the teacher's explanations is that the dialogic exchange seems to be controlled by the ICT structure above learner understanding. It is also not aligned with the policies as his teaching approach is linear and he does not engage multimodality in his teaching. The policy framework advocates that usage be flexible and Conole and Dyke (2004) consider non-linearity to be an affordance that gives pedagogical value to the use of ICTs. Although in the enacted practice there is both conversation and digital technology engagement the role that each plays is of significance to the extent that learning is taking place.

The significance of the roles are manifested in the use as an interactive media. The espoused practice has already been discussed in the interpretation of the teacher's statement. In the enacted practice, Sizakele covers a lot of content. Considering that the curriculum statement for the subject he teaches says learners at this level need support as they do not have adequate skills, covering 8 aspects of a topic in grammar in 30 minutes in a second language is too much for learners to fathom as in this case they struggled to give appropriate feedback. It is this type of acceleration of goals that ends up being detrimental to learning. Furthermore, the ICTs used tend to dominate the teacher's pace of covering content in the sense that when learners indicate by their responses they need more explanations and practice he carries on until finishes going through the slides. However this teacher is able to interpret the structure to his learners adequately and yet because he does not give them time to practise and perhaps engage other modal texts and media to bring his interpretations to life, his learners struggle to adapt to them. Based on the Conversational Framework, the interaction between teacher and learner is important in determining the re-descriptions and adaptations. In this case because the teacher does not engage other teaching strategies and teaching resources, to bring learners to shared descriptions of the concepts through the interaction, the content remains inaccessible. In the interactive medium he complies in the sense that he engages the immediacy affordance and uses conversation to respond to the feedback he gets from learners by amending their misconceptions in the enacted practice. This is not optional as learners do not have access to ICTs as the policy seems to assume.

Conclusion

Although there is consistent engagement of ICTs in both enacted and espoused practices, Sizakele's beliefs about pedagogical value does not comply with the policies and the theoretical framework adopted by this study because practice is not related to learning. The reason could be that he seems to be using the lecture method which supports the transmission teaching method. It is left to learners to make sense of the huge content they are covering as the teacher steadily goes through his slides. Based on this observation, Sizakele's practice coherence does not mean his ICT integration is aligned with ideals about teaching with digital technology. Instead, it is driven by his determination to achieve operational benefits and is therefore not associated with enhancing learning as the policy advocates. In other words, it is not used to "support the Conversational Framework and thereby assist the learning process" (Laurillard, 2002:89).



Takalani

Role of ICT teacher statement: *a learner learns quicker because they learn things that they actually see… they also eh, you know, remain with the picture.*

This statement seems to imply that engagement of visuals during the learning process results in learners learning quicker. Learning quicker seems to mean grasping concepts faster. Hudgins (1977) argues that unless visuals are interpreted for the learner, their use might hinder learning unless the learner is tutored on how to interpret them. Where remaining with the picture or enhancing retention is concerned, Vernon (1954) discovered that pictures do not have a significant impact on understanding and remembering text. There is therefore no guarantee that the teacher's claims are valid until proven so in his enacted practice.

Table 7.3: Summary of Takalani's classroom practice

Media Form	Espoused	Enacted	Policy: Practice aligned
Narrative	Structure: non-linearity; multimodal texts – visuals (T)	Structure: mono-modality; linear (T)	Espoused: (A) Enacted: (NA)
Interactive	Misconceptions amended: instant feedback (T)	Misconceptions not amended: Instant feedback (T)	Espoused (NA) Enacted (NA)
Communicative	None	No re-descriptions: Class discussion (NT)	Espoused (None) Enacted (NA)
Adaptive	Concretise theory: diversity – understanding and retention(T)	None	Espoused (A) Enacted (NA)
Productive	None	None	None
Coherence	Incoherent		Espoused (Mostly A) Enacted (NA)

While the teacher's assertions may be acceptable, their success depends on whether the supportive conditions are present. In the enacted practice Takalani does not use visuals at all in the narrative media form, instead he uses mono-modality (written text only) – for both the revision exercise and the assessment he gave to learners. Visuals or images could have been used to remind learners of the descriptions of the concepts they had learned. The table above depicts Takalani as believing and

actually using ICTs to present structure and yet its use, particularly in his actual teaching is insignificant and far from the benefits described in his espoused practice. Using bullets to display sub-headings and thereafter narrating the content without engaging technology cannot be described as using it to help learners learn quicker or remember as in this case, what they have learnt before. The conversation, simply takes over, disregarding the presence of the technology and the role it has played which is presenting the bullet. The use which is linear in the actual practice can be associated with the activity the class is engaged in and the type of assessment as they were required to remember specific items in the concepts. Learning should "go beyond the specific experience, to offer the symbolic representation that allows the learner to use their knowledge in an unfamiliar situation" (Laurillard, 2002:16). There is therefore no coherence between the teacher's belief about technology and what he does with it. While his espoused practice is aligned to the policy, his enacted practice is not.

In the interactive medium form Takalani applauds ICTs for giving instant feedback particularly during assessment. The assumption seems to be that this experience is part of learning, and yet when asked what he does with the feedback, the learning intervention does not relate to the feedback. In the assessment, when the software displays the class results and the correct answer is provided, the assumption seems to be that once learners see the answer their misconceptions are amended. In his enacted practice, the interaction between the teacher and learners is such that it does not facilitate emergence of misconceptions but is done in such a way that learners give the correct answer all the time as the teacher prepares them for that anywhere. What they say is not a result of their individual formulation of the answer, but they are filling gaps that are missing from a readily available frame provided by the teacher. It therefore becomes difficult to describe the feedback from learners as of value to their learning experience. Therefore both the conversation and the ICT fail to provide evidence that can be used to determine their pedagogical value at the interactive level. Since learners do not make visible this process, it becomes difficult to ascertain that the display by the ICT is of pedagogical value based on the analytical framework in this study. Alignment with the policy also cannot be confirmed because there is no evidence that the ICT has contributed to the learning process.

The communicative media form is not mentioned in the espoused practice but the actual learning process appears to be collaborative. The teacher seems to be collaboratively working together with learners in retrieving stored information in their memories. However, the extent to which learners are participating in the learning activity tends to be minimal. While policy states that ICT usage should be flexible enough to promote collaboration, the description and the extent to which this

should be done is not provided. In this case collaboration is at verbal interaction and it does not promote re-descriptions as both align them to the topic goal.

In his espoused practice, Takalani implies that his use of ICTs concretises abstract concepts to learners as they view occurrences or events that depict them. It is this involvement that he believes gives learners an experience that they cannot forget. However, there are elements that emerge in his espoused practice that could contribute to the absence of engagement of this media form in his enacted practice. For instance, he admits that while his use of visuals has benefits, some learners still fail and this could be because of lack of understanding and also associates that with having a low IQ. He also believes the language that is used in the technology could be a barrier to their understanding. All these are issues of symbols that need to be interpreted (Laurillard, 2002; Hudgins, 1977; Kennedy, 1974). What seems to be lacking even in the engagement of the narrative, the interactive and the communicative media forms in his practices is his role of interpreting the representations, which could be the reason why he seems to wonder why some of his learners are still not doing well. The fact that this teacher has had a year using this technology could contribute to his struggle to make sense of some of these ICT benefits that promoters of ICT use present (including policies) without explaining. A case like his is a challenge because while he is adopting and trying to adapt the technology to his teaching, he still has to establish the following: a) his role and that of the technology, 2) what else technology can do to enhance learning to assist those who are struggling, 3) how he should implement what he now knows about the benefits of the technology 4) how the technology can help address his learners' needs. It is such information perhaps that policies need to address to avoid this shallow engagement with technology.

Conclusion

Takalani has been using ICTs for a year and it is possible that his beliefs about ICT benefits could be informed by the ibox sponsor who has trained him on using it as a teaching tool. It is therefore possible that his practice incoherence is related to these two factors. His key 'statement' indicates that he is aware of the pedagogical value of ICT affordances. Although his responses at face value give the impression that his learners benefit educationally from his use of ICTs. He seems not to have theoretical tools to support his integration of ICTs into his teaching. Such teachers "are unlikely to develop approaches to teaching and learning which harness the potential of ICT for enhancing learning" (John and Sutherland, 2005:412), until they are offered these in training programmes. It is these characteristics and reference to learning benefits that the policy frameworks value that Takalani is not aware of. This case demonstrates the importance of adhering to

Vandeyar's (2015) call for explicit policy guidelines that give direct indications on how to integrate ICTs.



Mpetha

Role of ICT teacher statement: *it comes straight to what is needed. The ICT helps with the procedure, because without procedure you cannot do anything.*

In this statement, Mpetha attempts to demonstrate how relevant and handy ICTs are in a teaching and learning experience of his subject. He believes making explicit mathematical processes or rather how to get to the answer when solving a problem is key to learning his subject and ICTs possess affordances that make that possible. Considering that the CAPS document for mathematics highlights how this subject operates in symbols and notation to describe "numerical, geometric and graphical relationships" (DBE, 2011: 8) that could justify why this teacher values the role that ICTs play in the learning activity by concretising the abstract process.

Table 7.4: Summary of Mpetha's classroom practice

Media Form	Espoused	Enacted	Policy: Practice aligned
Narrative	Structure, links: multimodal text; non-linearity (T)	Structure, links: multimodal text; non-linearity (T)/ (NDT)	Espoused (A) Enacted (A)
Interactive	Misconceptions amended: immediacy; instant feedback (T)	Misconceptions amended: immediacy; instant feedback (T)/ (NDT)	Espoused (A) Enacted (A)
Communicative	Communicative: Group task discussion; class debates (T)	Communicative: Group task discussion; class debates (T)/ (NDT)	Espoused (A) Enacted (A)
Adaptive	Concretising theory: diversity; material design (T)	Concretising theory: diversity; material design (T)/ (NDT)	Espoused (A) Enacted (A)
Productive	Knowledge Construction: articulation; authentic problems (T)	Knowledge Construction: articulation; authentic problems (T)/ (NDT)	Espoused (A) Enacted (A)
Coherence	Coherent		Espoused (A)

In the narrative media, Mpetha highlights and demonstrates how important his materials design skill is in manipulating technology to produce the effects he wants to make explicit his presentation of the complex structure. In his espoused practice he describes how he engages multimodality during his teaching. His presentation of structure seems to be non-linear as it entails making connections with other subjects, real-life experiences and integrating those into understanding the processes of solving mathematical problems. Although Mpetha's enacted practice is an amalgamation of all media forms, this study separates them in order to define the type of benefit for each learning experience. His non-linearity seems to demonstrate the 'flexible usage' the policy proposes in its framework. In his use of 6 slides Mpetha is not limited to the use of technology but he incorporates role play, examples, explanations, and links with concepts from other subjects, gestures and prior knowledge to interpret and make explicit the symbols that make up the concept. This is a clear demonstration of the complexity of integrating not only the media but all the teacher can 'lay his hands on' to help make learners understand new knowledge. The policy framework advocates for meaningful acquisition and this teacher seems to achieve that through use of multimodality and non-linearity in ICT affordances. Although the ICT use tends to establish the structure or its development, Mpetha does not just present and leave it on the platform as is done by Moruti, Mshini and Takalani, but pauses it, comes back to it, links different aspects of it within it as he develops the structure.

As the teacher engages in this interchange he uses the interactive media form, not only as in digital technology, but other media and teaching methods as well. Learner feedback is elicited through question and answer that is used to identify learner misconceptions or lack of concept thereof and once identified, the teacher then uses the pedagogical ensemble, including ICTs to amend in preparation for the next level in the development of the concept. His use of the feedback relates to the policy framework in the sense that he uses it as part of learning. Mpetha's engagement of the immediacy affordance appears to be different from that implied by other teachers who associate it with covering more content objects. In his case, acceleration of curriculum goals is associated with creating a learning environment that promotes the development of appropriate thinking skills and meaningful acquisition of the processes involved in problem solving. These are curriculum goals for teaching and learning mathematics. On the other hand, Mpetha engages the technical aspect in his utilisation of the immediacy affordance in the sense that he is able to seamlessly move from one slide to the next as he tries to make visible the links and development in the concept. This is all supported by the classroom conversation he is using to guide learning.

The communicative media form is mentioned in the teacher's espoused practice in his description of how he uses feedback from the ICT after formative assessment to remedy identified learner weaknesses and utilise strengths. It is then that after evaluating the statistical feedback, the teacher creates groups where learners work with each other to tackle a carefully selected task that addresses the weakness identified. The class presentations engage learners in debates that also contribute to re-descriptions of concepts as learners argue for and against each other's understandings. In the enacted practice, learners were only given an opportunity to work in groups in their exercise books. The ICT was only brought in when the teacher had to explain challenges reported by learners as they worked in groups. The policy framework's description of the engagement of the communicative media is related to the learner using the technology to collaborate and that is not the case with both the teacher's espoused and enacted practices. However collaboration in his case which is done through non-digital media results in what the policy advocates for, which is learning through the experience.

The engagement of the ICT as an adaptive media is emphasised in the teacher's description of his materials design. For him it is the design that promotes issues of diversity. In his enacted practice he makes this view clear in the way each slide is designed. It is constructed in such a way that it links with aspects in another slide to make visible the connections and the thinking process that learners should follow when solving mathematical problems. Animation is used to help learners see how graphs are drawn and interpreted and to present a different level on the slide content. The policy's emphasis is on catering for learner diversity which the teacher does. The ibox sponsor materials could have influenced his value for use of real-life experiences in his examples to help learners relate to mathematics abstract symbols in addition to what he does with digital technology. Although the role play does not engage digital technology, it is incorporated in the actual teaching to support the ICT which at the moment of use learners needed to experience it to make sense of a phase in the concept structure.

The teacher engages the productive media form at teacher level and learner level, which the policy framework does not do. At teacher level, Mpetha believes his presentation models what learners should do when presenting their knowledge construction in group tasks. In his enacted practice the teacher's use is aligned to the policy in the sense that he provides learners with both technical and cognitive skills needed for knowledge construction when they do their group presentations. Thinking skills are developed as the teacher makes explicit in the adaptive and narrative stage the process of establishing mathematical understandings.

Conclusion

Mpetha's espoused and enacted practices are coherent. It is possible that his rich technical and teaching repertoire account for his ability to conceptualise and also create a learning environment that makes it possible for learners to learn abstract mathematical symbols and problem solving processes. This could be because "both personal theories of teaching and the level of competence with ICT play a major role in how teachers implement ICT and their perception of their own and their pupils' motivation: (Camilla and Marta, 2001: 63). The process in his statement is enabled by his ability to design and present effective e-learning material. He uses classroom conversation as a thread that knits or joins everything in the composite experience together. The feedback from the interaction determines the direction classroom dialogue takes. While his practice is aligned with compartments in the policy framework, they do not demonstrate this complexity. As already pointed out in Chapter 6, policies do not provide this detail in the integration of digital technologies that this teacher demonstrates. Coming straight therefore seems to mean helping learners make sense of the concepts taught. According to the policy framework, that is the core purpose for using ICTs.



Mlingani

Role of ICT teacher statement: *Like if you are not teaching with supplement, it's like the survival of the fittest. Exposing them to different answering methods… one of the reasons it's the language.*

The digital technology Mlingani uses is the supplement and what he says accentuates his reliance on it for catering for diversity. Amongst the four metaphors Lubart (2005) presents is the 'colleague' that he describes as a partner. The way this teacher uses the ICT suits this description. If it is the survival of the fittest that could mean that there is no recognition of diversity in learning abilities or background. In the next statement, this teacher reveals the specific role that the ICT plays in his teaching, that of exposing learners to different teaching methods and the language. This on its own is aligned to the policy as its use is for the benefit of learning. Identification of educational needs should take precedence before digital technology is engaged (Laurillard, 2012).

Table 7.5: Summary of Mlingani's classroom practice

Media Form	Espoused	Enacted	Policy: Practice aligned
Narrative	Structure: multimodality – ICT (T) language and different methods (NT)	Structure: ICT – concept (multimodality + non-linearity) (T) and teacher interprets structure (NT)	Espoused (A) Enacted (A)
Interactive	Concepts amended: misconceptions revealed (NT) - different methods (T), promote exposure to misconceptions	Concepts amended (NT): immediacy in teacher support (T);	Espoused (A) Enacted (A)
Communicative	Re-descriptions: class debate (NT) – different methods; teacher – ICT collaboration (T)	Re-descriptions: Class discussion (NT)/ (T)	Espoused (A) Enacted (A)
Adaptive	Concretising theory: diversity – LoLT and different methods (T)/ (NT)	Concretising theory: diversity – LoLT and different methods (T)/ (NT)	Espoused (A) Enacted (A)
Productive	Knowledge construction: exposure to subject thinking skills (T)	Knowledge construction: exposure to subject thinking skills (T)/ (NT)	Espoused (A) Enacted (A)
Coherence	Coherent		Espoused (A) Enacted (A)

In his engagement of the narrative form, this teacher describes how the ICT supports his teaching to cater for learner subject needs. For instance he is aware that because his learners are struggling with the language of teaching and learning, it becomes difficult for them to understand the content, and exposure through ICT use appears to be useful. In his enacted practice, the role played by the teacher and ICT is demonstrated. The teacher uses his conventional way of teaching which is, talk and chalk while the video engages contemporary technology and methods of teaching. Mlingani introduces his lesson by using a teaching approach that the video uses, that of storytelling. When the video's turn comes, in a way, it establishes the teacher's presentation and uses the story to present the content structure as well. When the teacher feels there are potential conceptual or language barriers, the technology is paused and the teacher interprets and explains. There is therefore multimodality in his teaching and learning experience. There seems to be non-linearity in the sense that there is no fixed pattern when each takes their roles as it depends on whether the teacher has identified what he feels needs to be explained or repeated for emphasis. The teacher is still in charge as he further explains the language used and elaborates in the teaching method used in the video.

In his use of the interactive media, Mlingani could be described as engaging immediacy in the sense that he is able to get this support instantly whenever he needs it in the process of his teaching. However in the enacted practice, the video and the teacher tend to take turns in their presentation of the lesson. Although there is no interaction between the video, the teacher and learners, (it being a

narrative media) the conversation the teacher engages in with learners provide the interaction where he then gets feedback from learners which reveals misconception. Once identified, the teacher uses the traditional way of teaching by explaining on the chalkboard as he engages prior knowledge, examples and other teaching methods. Unlike Mpetha and Bambisana, Mlingani completely relies on his explanations to amend identified, even potential misconceptions. The acceleration of curriculum goals as advocated for by the curriculum could be in the sense that the learning goal is accomplished within a short time as the teacher and the video support each other as they expose learners to different problem solving methods and as the language barrier is addressed in the teacher's interpretation.

As the teacher engages with the video in this collaborative teaching activity, the different ways of explaining concepts promote re-descriptions and all this is reflected in the enacted practice. The teacher appears to be engaged in a collaborative activity with learners as they work out the problems posed from the video. The teacher keeps asking them what should be done next in the process and learners provide the teacher with the steps. Whenever they are not sure or they offer a wrong response, the teacher elaborates further to guide them. Once understandings are established, the video is played, carrying on from where it left and providing the answer for the task completed. The process followed on the video is different but the answer it arrives at is the same. The teacher then stops and explains the differences so learners are familiar with both methods. This study considers this as a collaborative activity whose structure is different from that of Laurillard (2002). Its description is also different from that of the policy and yet from a broader understanding of what collaboration entails in a learning activity, this is appropriate.

The fact that this teacher is able to provide the different methods of teaching and deal with the language barrier through his collaboration with the technology shows he caters for diversity and therefore utilises the ICT affordance that accommodates diversity. The teacher's conversation plays a big role in this media form. While he cannot use the technology on the video, by integrating it into his teaching, he is able to provide learners with these opportunities and though they cannot interact with the video presentation, the teacher is able in his enacted practice to interact with them through conversation. Again this is not the ideal situation for the policy framework and Laurillard's (2002) Conversational Framework, but what counts is that the teacher provides the same learning experience but differently. The teacher is simply using what he can do, what he cannot, as Mshini says, he opens space for it, to achieve the same goal. The teacher explains language in order to close the gap between learner and ICT in terms of terminology and methods used.

This teacher believes that whereas learners do not have access to ICTs, his teaching approach empowers them to make decisions on what mathematical problem solving methods to use. Although his learners do not use digital technology to construct knowledge, his style of usage is aligned with what the policy framework advocates for, which is usage in a way that desired thinking skills are developed. Although this was accomplished during enacted practice, learners were not given ample opportunity to articulate their understanding of the concepts learnt as he interrupted some of them while they were still working toward the solution. Based on this teacher's claim that his pass rate has increased, this teaching style could be contributing to learner performance.

In a partnership, each partner has a specific role he or she plays as all work together toward the same goal. That is what seems to be happening in Mlingani's practice though the descriptions of how he integrates ICTs seem not to be aligned with the policy. This study argues that what matters is that the educational goals are achieved in the engagement of ICT in the learning process. Secondly, what has been of concern for this study is what it is in this teacher's usage of this presentation media makes his learner performance improve as he claims? While it is possible that there are many other reasons both in and outside his teaching that could be contributing to the achievement of the curriculum goals, there is a strong contingency that his teaching has been positively influenced by the teaching method used by the video. For instance, in the lesson observed, the teacher told more or less the same story as that on the video in his introduction of the new concept which he dropped later and resumed to what seemed to be his natural style of teaching in his explanations in particular. On the other hand, the video maintained the story telling style in all its explanations. Having used the video for the past 2 years could be contributing to his incremental matriculation pass rate.

Conclusion

Mlingani's use of ICTs demonstrates how classroom conversation and the conventional way of teaching can work hand in hand, leading to the transformation and enrichment of learning through the use of digital technology. His awareness of the role each of them (teacher and video) plays seems to facilitate the coherence between his espoused and enacted practices. The presence of ICTs does not derail the teacher's responsibility of "Making student learning possible" which implies that "the teacher must know something about student learning and what makes it possible" (Laurillard, 2002"11). This teacher is clear with this aspect which is reflected in the policy framework and for that reason, his practices are compliant. Mlingani's compliance introduces another dimension to the

integration of ICTs where the conversation or teaching takes turns with digital technology to develop understandings and enrich the process of learning which is compliant with the policy.



Moruti

Role of ICT teacher statement: *For me it is but one of the (interrelated group of) tools that we use to assist teaching and learning. Using ICTs as an experienced teacher enhances your performance to an extent, because you see, ICTs cannot close up lack of capacity… So it can play a limited part up to a point.*

This is the oldest teacher and in addition, he has had more experience with using ICTs than any teacher in this study. His views about the role of ICTs are slightly different from other teachers in the sense that he is adamant that the technology cannot make a difference in achieving educational goals on their own. This view alludes to what Sandttoltz, Ringstaff and Dwyer (1997: 174) that technology "is only but one tool among many" and that it should only be "used when it is most appropriate means of reaching a learning goal". His statements above are an attempt to accentuate his argument. Some of these premises will be addressed later in this chapter as they are in agreement with literature and might actually lead to directing this study's attention to pointers that could be of value in identifying features that would matter in the ICT teacher training framework to be developed. However, his enacted practice helps to gauge the extent to which he implements his beliefs.

Table 7.6: Summary of Moruti's classroom practice

Media Form	Espoused	Enacted	Policy: Practice aligned
Narrative	Structure: multimodality and connections (T)	Structure: Linear; multimodal texts (T)	Espoused (A) Enacted (NA)
Interactive	Misconceptions amended: feedback from question and answer (NT); immediacy – more content covered (T)	Misconceptions not amended as they are not revealed through the interaction (NT): immediacy – display (T)	Espoused (NA) Enacted (NA)
Communicative	None	No re-descriptions: class collaboration – learner input is led (NT)	Espoused (None) Enacted (NA)
Adaptive	Concretising theory: Diversity – access to real-life experiences (T)	Concretising theory: diversity – illustration of the map (T) and local examples used (NT)	Espoused (A) Enacted (NA)
Productive	None	None	None
Coherence	Incoherent		Espoused (Partly NA) Enacted (NA)

In his use of ICTs as a narrative media form, Moruti believes they are of benefit in presenting the concept structure. His espoused practice reveals the following components of the concept structure: steps, process, breaking down of complex aspects and in illustrating links. This demonstrates how this teacher knows what ICT affordances can contribute to apprehending structure. These roles also suggest engagement of multimodality in the presentation of lessons. However, in his enacted practice, this teacher's teaching approach is contrary to his assertions. The extent to which he engages technology tends to be restrained as his teaching (conversation) dominates. There is linearity in his use of digital technology. When a new element of the topic is introduced, a slide is projected on the wall and thereafter, the teacher focuses on his description or interpretation of the concept and once done, moves on to the next slide. This pattern is followed until the end of the lesson. The teacher's descriptions are clear and logically presented for easy understanding. In his engagement of multimodality, there is some element of constraint, although there are different materials design clues – colour, heading, shape to represent section covered about the town described, their use is static and inflexible. This does not align with the policy as it advocates for flexibility in ICT usage which may include drawing from other resources and teaching strategies. The materials Moruti uses are from the Department of Education and he seems to have used them as they are. In the interview the teacher confirms that he is able to modify these to suit learning and yet aesthetic features which could have been brought in to make explicit the descriptions are not included. The reason could be that he believes ICTs do not have affective impact on learners.

In his espoused practice Moruti values ICTs as an interactive media in the sense that he is able to cover a lot of content or "pump up a lot of information" as he states before learners gets bored. This is another interpretation of the policy's assertion of acceleration of curriculum goals, if he is aware of it. In his enacted practice this teacher does not seem to cover much content with the ICT but he says much about the 2 slides he uses to display the different elements of the 2 types of towns he teaches about. In such a case, covering of much content is not directly related to the instant and quick presentation, but in offering comprehensive interpretation of the representations. Although the interaction that occurs in the dialogue between teacher and learners, what does not align with Laurillard's (2002) Conversational Framework is his failure to create an environment where learners can reveal their misconceptions about the concept so he can amend them if need be. The reason could be that the teacher is deliberately using the lecture method or he believes his teaching is adequate enough (as an experienced teacher) to make learners understand or to give them information before they are bored.

In the espoused practice, Moruti does not indicate that he uses ICTs as communicative media. The reason as in other teachers could be that in the enacted practice he does not directly use it for this media form but rather engages it in the conversation. In addition, his use of classroom dialogue is not aligned with the Conversational Framework as the learning environment offers no re-descriptions. This is because of the type of collaboration that seems to be completely controlled by the teacher, with learners giving insignificant responses that do not need much of high cognitive engagement.

The adaptive media form in the enacted practice is characterised by the use of a map which illustrates the concepts taught. There are no features on the map that would help bring learners to the real-life experiences. However, reference is made to local examples that learners can relate to in the classroom conversation. His espoused practice is aligned to the policy framework because he makes reference to ICTs providing learners with real life experiences, making it easier to concretise out of reach geographical occurrences.

Conclusion

While Moruti appears to be aware of the benefits of ICTs in teaching and learning, his attitude towards the use of technology for teaching and learning seems to restrain him from enacting them at the level of his ICT proficiency. That results in the incoherence between his espoused and enacted practices. The teacher's belief about his engagement of the narrative and the adaptive media is aligned to the policy framework. On the other hand, his enacted practice is not aligned in the sense

that the use of ICTs is left in the background while the teacher carries on with the classroom conversation. The product of the lesson cannot be associated with the use of ICTs as its presence is left in the background, not integrated with teaching and learning.



Bambisana

Role of ICT teacher statement: *It's easier for learners to understand what they can see and relate with. Some topics are just abstract things but if they can see what they are talking about…it makes them understand them more.*

Bambisana's statement is associated with the ICT's affordance of making learners experience what they learn and by so doing facilitate better understanding of concepts. For her visual images promote efficient retention of concepts. This relates to Takalani's statement and the question is if their understanding based on the framework or media forms is the same.

Table 7.7: Summary of Bambisana's classroom practice

Media Form	Espoused	Enacted	Policy: Practice aligned
Narrative	Structure: multimodality – visuals and understanding (T); linear (NDT)	Structure: multimodality; non-linearity (T) + (NDT)	Espoused (A) Enacted (A)
Interactive	Misconceptions amended: immediacy – visuals (T)	Misconceptions amended: immediacy; immediate feedback (T) + (NDT)	Espoused (A) Enacted (A)
Communicative	None	Re-descriptions: class discussion (T) + (NDT)	Espoused (A) Enacted (A)
Adaptive	Concretising theory: diversity – visuals – out of reach scenes (T)	Concretising theory: local knowledge linked with visuals in different types of representations (T) + (NDT)	Espoused (A) Enacted (A)
Productive	None	None	None
Coherence	Coherent		Espoused (A) Enacted (A)

In the narrative form, Bambisana's enacted practice is coherent with her espoused practice although there are other aspects of teaching that were not mentioned in the espoused practice. The espoused practice for instance points out that attention is important for her as it promotes understanding. She believes presentation of visuals draws learner attention and helps them understand thereby implying that ICT use has affective influence that promotes cognitive engagement. The conversation plays a

significant role in the interpretation of the structure. That is evident in her teaching as learners listen intently as she engages different media that seem to keep them focussed. As she does so, she extensively engages both digital and non-digital technologies to enhance her explanations. This relates to the subject curriculum goal she states at the beginning of the lesson which is to be able to interpret geographical processes, describe and explain their interrelationship through different representations. She therefore models how to present different representations of the concept (intrusive forms) she is teaching.

In the interactive form, the espoused practice gives the impression that the teacher values ICTs for their ability to help her teach more. In the enacted practice the teacher meaningfully engages her learners in the progression of the lesson through use of teaching resources in order to augment the classroom conversation. For instance, as misconceptions are identified, the teacher draws from both digital and non-digital resources to try and make explicit her explanations. Bambisana's compliance with policy in this media form incorporates both ICTs and non-digital technology.

The communicative media form has not been indicated in the espoused form, and yet in the enacted form, it carries the learning process in the sense that the learning activity is collaboration between the learners and the teacher. As this collaboration takes place, the teacher and the learners are able to offer re-descriptions that seem to enhance learner understanding as they work towards the topic goal. Her integration of the technologies and the conversation is aligned to the policy framework as it promotes this collaboration.

Although the audio visual texts are mentioned in the espoused practice, focus on the lesson observed is on presentation of different forms of image representations. All effort is made to make explicit the changes in land forms. For instance, one intrusive form could be presented and described in colour, black and white, photograph and in drawing and each helping to deepen understanding about the concept. She engages her repertoire of teaching resources as indicated above to concretise the concepts taught.

The policy framework seems to be in agreement with Bambisana's classroom practice with ICTs in the sense that she is able to use ICTs to enhance learning. What is missing is the creation of this pedagogical 'ensemble' through use of not only digital but non-digital technology that Bambisana demonstrates as she makes vivid the value that ICTs bring to her teaching in the policy description. The difference between her and Takalani is that her use includes interpretations, meaningful engagement with different resources in his teaching. She also demonstrates what Moruti claims in

his statement that it is not only ICTs that bring pedagogical value, but ‘a group of things which depend one upon the other’ which he does not reveal in his enacted practice.

Conclusion

Bambisana’s use of ICTs is driven by how she believes her learners can best learn her subject. In her enacted practice, the teacher is able to enact what she espoused as she demonstrates the integration of ICTs into different elements of pedagogy that include teaching methods and non-digital media. This relates to the findings in John and Sutherland’s (2005:410) study where teachers expressed concern that “there should be a dynamic relationship between digital and non-digital activities so that disciplinary-based knowledge and skills would not fall into desuetude”. This teacher demonstrated how to implement this perception elaborately. The teacher’s enacted and espoused practices are aligned to the policy frameworks. Her aim to prepare learners for acquisition of the subject content seems to be the reason for the policy alignment.

The teacher overviews above serve to highlight features that are emerging from the relationships between practices and the policy framework of each case study in isolation. In the summary that follows, a coalition of these features will be presented.

Summary

The focus of this study is on understanding the ICT pedagogical integration of the seven participating teachers and to use the findings to inform the development of an ICT teacher training programme. The purpose of the intervention to be developed after this study will be to help teachers; especially those in classrooms with limited resources integrate ICTs effectively. At this stage, the relationships of the triad (enacted, espoused and policy), through the use of the analytical framework has yielded understandings of the nature of integration of these teachers that appears to help in giving deeper insights into the concept under study.

The following table summarises the triad relationships for each teacher. ‘√’ represents coherence and ‘X’ represents incoherence. The last column elaborates on the nature of integration by stating whether the ICT is integrated into the pedagogy or is isolated from it. Under policy, there will be a comment on accountability for the teacher practice. Lastly the emerging insights will be presented as a conclusion.

Table 7.8: Summary of the triad relationships or coherence

Teacher	Esp. and Enac.	Esp. and Pol.	Ena and Pol.	Comment on nature of ICT integration and reason or circumstances		
				Integration	Circumstances	Policy
Mshini	X	√	X	isolated	for display, used when needed	lack of guidance on integration – affordances
Sizakele	√	X	X	isolated	for display, linear usage, control of learning pace	lack of guidance on integration – value for learning
Takalani	X	√	X	isolated	for display, superficial engagement	theoretical understanding for integration
Mpetha	√	√	√	integrated	to concretise abstract mathematics processes	enhancing learning involves theoretical understandings on subject teaching – ICT skills are a bonus
Mlingani	√	√	√	integrated	exposure to mathematical language and methods	knowledge of learner subject learning needs helps to enhance learning
Moruti	X	X	X	isolated	for display, linear usage	change of attitude by demonstrating the role of ICTs in the pedagogical integration process
Bambisana	√	√	√	integrated	to facilitate acquisition of disciplinary knowledge	knowledge of best ways of teaching and learning the subject and using ICTs to accomplish that

Practices of three of the seven teachers are coherent with the policy framework. It appears that as long as teachers' intentions to use ICTs for teaching are related to disciplinary demands for learning it, their integration tends to align with the policy framework. These goals seem to influence decision making on what media forms to engage, what ICT affordances use to cater for learner needs and or backgrounds. However that does not mean the other four teachers do not have the knowledge or awareness, but they are not articulating it (awareness) in relation to the ICT role in the teaching and learning process. That could be the reason why the four isolate the technology from their actual teaching.

Chapter Conclusion

It seems that for pedagogical integration to be of value, it should be part of the teaching and learning process. The teacher should be able to articulate and demonstrate why and how it is integrated into teaching and learning. It should therefore not be isolated but be part of the process. Secondly, the factors that seem to influence the extent to which integration is implemented appear to relate to the policy are: attitude toward ICTs, subject needs, learner needs, teacher efficiency and inexperience.

Chapter 8

Conclusion

Introduction

In this chapter the theory that has been engaged to try and make visible the value in the ICT pedagogical integration of the seven South African teachers' practices will be reviewed in the context of the discussions that have been engaged in Chapter 7. This will be done in order to make explicit the contribution that this study makes to this field. Concerns regarding the implementation of the concept will be highlighted and suggestions made for further study.

Summary

The aim of this research is to examine the relationship between espoused, enacted practices and the South African education policy framework developed from an analysis of four policies. The investigation is meant to inform the development of a generic framework for preparing FET South African teachers for ICT pedagogical integration. Laurillard's Conversational Framework, her media forms and descriptions of Conole and Dyke's ICT affordances have been instrumental in helping achieve this goal.

Understanding of the complexity of how the Conversational Framework operates in a typical learning process, and the discovery that the order of the activities need not be followed as is, made it easier to draw the significance in the interaction between the teacher and the learner as evidence that learning is taking place. That enabled the researcher to make assumptions on whether an interaction or conversation for that matter was of value or not.

The education policies as guidelines for the integration process have been used to monitor and understand teacher practices to align value to what is expected in the South African education context. An understanding of the relationship between espoused and enacted practices is significant in the sense that it provides a comprehensive understanding of the extent to which teachers integrate ICTs into their subject teaching. The relationships as represented by the triad in Chapter 3, 5, 6 and 7 helped deepen the descriptions, explanations and interpretations of the practices as either espoused or enacted.

Findings

To present the findings, this study will respond to the research questions as follows:

Research question

What is of pedagogical value in the classroom practices of seven South African secondary school teachers with ICTs?

Sub-questions

1. What is deemed to be of pedagogical value by teachers in their own espoused practices with ICTs?

What is of pedagogical value varies and it relates to teachers' beliefs about ICTs, subject teaching and learning and learner and teacher needs.

2. What is implicitly assumed as of pedagogical value in the teachers' enacted practices?

The significance of the teacher as a mediator emerges as the agent for an effective ICT pedagogical integration process. Where the teacher acknowledges the importance of the role ICTs play in enhancing the classroom conversation, there is evidence in the enacted practice that the use has value in the learning process.

3. To what extent are teachers' espoused practices reflected in their enacted practices?

When teachers' beliefs relate to a specific teaching and or learning goal, it is usually reflected in their enacted practices. Where it is not, misconceptions, lack of experience and negative attitudes contribute to the inconsistencies.

4. What role do the South African education policies play in the pedagogical use of ICTs by teachers?

Although the educational policies' pedagogical value tends to be aligned with the theoretical framework as implied in the analytical framework, its weakness is in its failure as a guide to direct teachers on how they should go about implementing the process. The policies also seem to value the technical aspect over what Kozma (1994) refers to as the mental or cognitive part of the integration process.

5. To what extent are teachers' practices consistent with the assumptions of policy?

Teachers' practices are generally inconsistent with policy assumptions as they do not utilise the technologies to the extent that the policy advocates. The polilies' failure to present ICTs as co-participants in the teaching and learning process appears to be responsible for the teachers' struggle

to align their integration to that suggested by the policy. It is therefore, teachers who make clear the educational goals they want to achieve through their use of ICTs that seem to be compliant in their usage. While the four teachers may not have complied, it should be noted that this was not a reflection on their teaching and achieving learning goals but that their use of ICTs did not help to achieve them.

What is of pedagogical value therefore in the use of ICTs by the seven South African teachers varies depending on the teachers' awareness of the significance of their role as mediators in the learning process over that of media. The impact of the role played by ICTs and any other component of pedagogy depends on how proficient the teacher is in this integration process in the context of the curriculum. As long as teachers do not associate their perceptions about ICT integration with curriculum goals and principles for their teaching subjects, the pedagogical value of ICTs in their remains low.

Reflection on findings

Although the theoretical framework used in this study did not perfectly relate to the experiences of the teachers in this study due to the different contexts each worked from, it is its descriptions combined with that of other literature that helped modify it so that it applied to the township secondary school teachers. The adjustment helped in the sense that it enabled the researcher to see beyond technical aspects that tend to be disruptive in trying to identify models or good practice in studies of this nature. As a result, this study has not only learnt from the good examples but from negative ones as well as will be demonstrated in the next sub-section.

Development of concepts in the framework

The Conversational Framework (CF) has contributed to this study by making explicit what teachers and learners do in the development of learner concept understanding. Through it (CF), the conversation was made visible, complex as it enabled this study to determine the effectiveness of ICT integration into subject teaching. In order to make explicit the contributions made by this study, learnings about the media forms as applied in this study will be discussed first to prepare for a contextualised debate about the coherence of the teachers' classroom practices. Thereafter, the types of integration as characterised by each teacher's case will be presented. That will lead to the identification of key areas that seem to be pertinent in the preparation of South African teachers for ICT pedagogical integration. The theoretical contributions emerging from the discussions are presented in the conclusions of each theme.

1. Media forms and classroom practice

The intention of this section is to establish a modified description of Laurillard's (2002) media forms that has been necessitated by the incompatible context that the seven South African township secondary school teachers work in. In her book, Laurillard (2002) addresses university teaching. That inevitably positions her views in a different context from that of teachers in this study and yet her understandings on teaching tend to place all schooling or studying levels in the same plane. Her arguments that academic learning is "not directly experienced, and is necessarily mediated by the teacher" (2002:4); "Teachers need to know more than just their subject. They need to know the ways it can come to be understood, the ways it can come to be misunderstood, what counts as understanding: they need to know how individuals experience the subject" (2002:3); "It is the teacher's responsibility to create the conditions in which understanding is possible" (2002:1) demonstrate the generic approach she uses in her discourse about teaching. However, the responsibility she tends to give to learners is not appropriate for learners in secondary schools. For instance she says, "It is perfectly permissible to criticise an authority's argument, but students must give an accurate account of it, and their critique must be well argued" (2002:2) and "We particularly value those students who, in Bruner's phrase go beyond the information given" (2002: 2). While these qualities are good to have, they are not expected at secondary school level, even if they were, they would not be at the same level. Furthermore, her aim for presenting the CF is to "offer a way of thinking about teaching and the use of learning technology that is informed by a more elaborated understanding of what students do when they learn" (2002:5). In her case, learners are users of technology as her descriptions of media forms for instance seem to assume they have access to it. Based on these premises, this study adopted the CF with reservations that are revealed in the following discussions.

While the context might be different, this study has found the Conversational Framework to be useful in identifying ICT pedagogical value in teachers' classroom practices and in determining credibility of the education policies in offering sufficient guidelines on its implementation. The discussion that follows engages the language it uses in its development. As already been pointed out, the focus is on making explicit what it is that can be considered of pedagogical value in the classroom dialogue as the teacher and learners interact. The media forms developed from this open demonstration of the teaching or mediation process have been used in this study to detect where and when ICTs are used productively in the teacher practices. Each will now be discussed.

Narrative media

The purpose of the narrative media form in a learning experience is to provide

> a linear dynamic that links the components to each other via relationships, which may be causal, temporal, or motivational, depending on the content. Narrative is fundamentally linked to cognition by providing the structure that enables the reader to discern the author's meaning.
> (Laurillard, 2002:91, 92).

Engagement of multimedia in such a case enriches the teacher's descriptions of the world by making them visible. There needs to be recognition that this is a cognitive experience where the teacher and the learner need to engage each other meaningfully if the same understandings will be shared. This media form operates at the discursive level and this calls for the teacher to create a learning environment that helps the learner to experience or relate to the new knowledge. This situation demands that the teacher engages teaching strategies and different media to achieve that purpose as the word of mouth falls short in achieving that especially with complex and unfamiliar concepts. While digital technology is suggested, it is important for this study to be aware that Laurillard (2002:91) acknowledges that there are "traditional methods and media, such as lectures, books, films, and television programs, are all narrative in form, and for good reasons". In other words, each of the above has a role to play in the teaching and learning experience. It is not only the role, but the way that each "part of interrelated group of things which depend one upon the other and influence one upon the other" as Moruti states. That makes non-linearity (Conole and Dyke, 2004) an integral aspect of ICT integration if it is to enhance learning and teaching. With that being said, what emerges in the engagement of this media form is that the spoken word (as a media) in the conversation plays the main role in accomplishing this role. As much as this might sound obvious, Brodie (2007); Burbules and Bruce (2001) and other literature make clear the significance of this important aspect in teaching. Laurillard (2002) in her development of the Conversational Framework makes this complex process visible. What this study finds missing is the direct link between the CF and the media forms and their affordances, which this study exhibits, particularly in Chapter 5 and 7.

The ICT in education polices, together with related literature tend to side-line the existence and prominence of classroom conversation that Dron (2012) brings up in his argument that ICT integration should not be studied in isolation. By observing digital technology as it participates in that which makes learning happen, this study demonstrates the distinctness of each teacher case in its description of how ICTs can be integrated into the conversation. It has also shown how the more

explicit the role of each aspect is in the process, the more vivid and effective the implementation of this teaching approach becomes. Where it is not disclosed in both teacher practices (espoused and enacted), there seems to be minimal value associated with the use of ICTs, whether given prominence or not in the teaching and learning experience like the case of Mshini, Sizakele, Takalani and Moruti.

Interactive media

In her description of interactive media, Laurillard (2002:107) states that the user is free to "navigate and select content at will". This puts emphasis on the technical engagement of the usage and yet what is key is the demonstration of how this affordance augments the conversation in the learning and teaching experience. In this study, this aspect emits conflicting consequences. In the case of this study, the level of interaction and its utilisation to enhance learning varies. In some cases the immediacy affordance enables learning and in some, it disrupts it. Where it is empowering the conversation, feedback from the technology or the verbal (which is considered as media in this study) interaction resulting in its use leads to the identification of misconceptions and their amendment. This affords pedagogical value to the action. In cases where this affordance appears to be disrupting the learning process, too much content is covered and the pace tends to be determined by the technology in the sense that the teacher is inflexible (Sizakele). In some cases, the technology's affordance is not adequately used to promote learning through its meaningful engagement (Mshini and Moruti). In another there is complete reliance on it (Takalani) to the extent that there is no visible evidence that amendment of misconceptions has occurred. This study demonstrates how Laurillard's (2002) description of this media is enhanced by pedagogical components and how it enhances them with the guidance of the teacher.

Adaptive media

Although in her description, Laurillard (2002:127) gives the impression that the learner is the user in the learning context, in her statement, "It is individualised, private, formative feedback, which helps to build their understanding of the internal relations between theory and practice", her benefits of simulation, as an example of an adaptive media is more relevant to this study. She says,

> A simulation is a representation of the actions and events of the real world in a simulated world. The computer-based simulation is the first medium we have considered that is adaptive, in the sense that it gives intrinsic feedback on students' actions. The actions are inputs to a model, so the simulation is allowing the students to

> have a direct experience of the (simulated) world; it is not operating at the level of descriptions of experience; it offers direct experience, albeit simulated.
> Laurillard (2002:128)

This study recognises any media that is able to provide this experience as adaptive. For instance, role play, in a face-to-face learning platform gives learners a form of a real world experience as they participate in the activity. Conole and Dyke (2004) extend this notion by adding that this affordance caters for diversity. If that is so, any activity, whether digitally charged or not that contributes in helping learners adapt new information promotes inclusion of learners from different backgrounds. Teachers in this study who engage this media effectively seem to have taken their learner needs into consideration before they integrate the media. As a result, what they say links with what they do with the ICT. The teacher with programming skills (Mpetha), attests how his materials design contribute immensely to his utilisation of media to concretise mathematical problem solving processes. He believes, by so doing he helps his learners adapt their prior knowledge to the new concepts.

Communicative media

As already been mentioned, it is only the mathematics teachers who acknowledge their engagement of the communicative media form in both their practices. This could be related to their strong beliefs about how their subject should be taught and learned which they described well in their espoused practice. Laurillard (2002) and Conole and Dyke (2004) highlight collaboration as the affordance that is engaged in this media form. In the case of the rest of the teachers, this media form is not indicated in their espoused practice, but emerges in their enacted practice. It is possible that this is because they isolate the value of ICTs from the teaching they do. As a result most of them tend to either over emphasise or minimise the role of ICTs in their practices which is evident in their actual teaching.

Productive media

The productive media is not associated with the use of ICTs by all except the mathematics teachers. These teachers are aware of the benefits of using digital technology in preparing their learners for knowledge production. They value the development of learner thinking skills and their ability to apply and articulate their conceptualisation of the topics so that they can reflect on their understandings of the knowledge acquired. One of the mathematics teachers (Mpetha) emphasises the importance of giving learners opportunities during the lesson to apply what they have learned. The other mathematics teacher works with his class to solve problems posed in the video

presentation. Although this might not be considered as learner or individual production, the class meaningfully and collaboratively participates in the knowledge construction.

Teacher engagement of media forms

The teachers who incorporated all the media forms in both their practices are the two mathematics teachers in this study and that deeming them as the most productive users of ICTs in this group of teachers. This contradicts Howard and Marton's (2011) findings about mathematics teachers in their study who considered ICTs as not coherent with their discipline in their use of the legitimate code theory. The teachers' motivation in this study is to use ICTs to help make learning possible by creating learning environments that overcome learning barriers and develop mathematical thinking skills. While their engagement with the ICTs they use is different, each teacher is able to maximise their utilisation of digital technology to the benefit of learning. While Mpetha has the advantage of manipulating technology to make vivid mathematical processes, Mlingani diligently supports and is supported by the technology in the presentation of structure and in closing up the language gap that has the potential of hindering acquisition of knowledge.

On the other hand, the geography teachers integrate ICTs differently. Three of them have less than two years experience teaching with ICTs (Mshini, Takalani and Bambisana) while the other one (Moruti) has more than twenty years. The four of them have not mentioned their engagement of the communicative media form in their espoused practice and yet in their teaching they engage collaboration at classroom level. Takalani does not use visuals for the narrative and adaptive media forms in his enacted practice and yet that seemed to be his motive for adopting digital technology. It is possible that limited experience with the technology could have contributed to his failure to support learning with feedback from the assessment. Moruti's use of technology is distanced and relies more on the verbal deliberation in his presentation of structure. On the other hand, Bambisana makes all effort to integrate in such a way that different types of media support each other as they support her conversation or teaching. Mshini is the physical science teacher and in his case, his use of ICTs does not engage learners cognitively as he only uses digital technology to refer to questions on a word document projected on the wall. Otherwise his engagement of digital technology is absent in his teaching.

Sizakele, the English teacher only utilises the narrative and the interactive media forms in his practice and yet, because he is not using learner feedback to adapt his descriptions, his use of ICTs tends to limit understanding of concepts.

Conclusion

It is therefore evident that each teacher engages media forms differently, at different levels and the consistency in their practices is not regular either. The contribution that this study therefore makes to the teaching practice is that if policy does not make explicit the direction teachers should take when integrating ICTs into their teaching, these discrepancies are to be expected (Vandeyar, 2015). While there might be no problem with that, lack of guidance seems to lead to some teachers not utilising the technologies for the main purpose they should be used for, which is to enhance learning. What needs to be established is why that is so. The next section examines teachers' coherence to see if there are patterns that emerge from their practices that could be accountable to the extent to which they engage these media forms.

2. Coherence of classroom practice

The Conversational Framework makes vivid teachers' espoused and enacted practices through the interpretations from the analytic framework. While this study is interested in learning from what teachers value in their ICT integration, understanding the relationship between teacher practices helps justify their decision making and to know what informs their beliefs and what and how they influence each other. Ertmer et al. (2012:432) found that it is favourable circumstances that influenced alignment in their participating teacher practices like "change in access, change in students, and change in curricular emphasis". Teachers in this study do not have those encouraging conditions. It is therefore in the interest of this study to find out what it is that influences the consistencies and the inconsistencies in the teachers' engagement of ICT affordances. The responses to this query are presented below.

Coherence: Clear articulation of roles

This study has found that when the roles and relationships of the conversation and ICT affordances are clear to teachers, there is coherence. That however does not necessarily translate to integration that promotes enhancement of learning because of the following reasons:

Roles based on technology affordance

In the case of Sizakele for instance, there is clarity in the role the ICT plays in making his teaching under the circumstances efficient. Nonetheless, that results in him paying more attention to the technology and what it offers. Consequently, he neglects his role in making learning possible in his enacted practice by being inflexible he can cater for learner needs. Although that might not be a favourable situation, it serves to confirm the nature of the value he has for his use of ICTs.

Roles based on subject and learner needs

In the case of the three teachers whose practices are coherent, their thrust in their integration is on enhancing their teaching and learning. The two mathematics teachers for instance have identified what their learners' needs are (developing mathematical thinking skills and acquisition of the language) and are utilising ICT affordances specifically to alleviate those challenges. While these motives could contribute to the type of ICT use, they are aligned to the curriculum aims for the subject. It is also in their ability to incorporate all the media forms in their practices that is of interest in this study. Could it be that their teaching approaches are simply aligned with the Conversational Framework? What is clear is that there is evidence that by examining their ICT use through its lens, it becomes possible to see value in their use of technology. All the beliefs of the mathematics teachers match their actual practices and it is only they who state the role of their classroom conversations in their espoused practices and are able to manifest these in their enacted practice. It appears, as teachers articulate the demands for learning their subject, at the same time they reflect the subject curriculum goals which they are engaging ICTs to accomplish.

While the geography teacher's (Bambisana) enacted practice is an elaboration of the espoused practice in the sense that the communication media only emerges in the actual teaching, the extent to which she integrates is a clear demonstration of how both digital and non-digital technologies can support each other and be integrated into classroom conversation to enhance learner understanding. It is also evident that while she is aware of the value ICTs bring to her teaching, she upholds her conventional teaching and uses digital technology to augment it. This element is not explicit in the policies and as a result it is possible that they might be misinterpreted as implying that ICTs are of more value than teaching. The existence of that which is enhanced needs to be made clear as a starting point as demonstrated in the approach Laurillard (2002) takes by establishing a firm foundation for the conversation first through her framework before she categorises the media forms.

Incoherence: Inability to enact ICT policy framework

The remaining three teachers' practices are incoherent and each case is different from the other. However, in all cases, the teachers' beliefs are aligned with the policy in the sense that they seem to be aware of how ICTs should benefit their teaching. The reasons for the inconsistencies are as follows:

a) Inexperience with ICTs

In the case of Takalani, the first geography teacher, his beliefs appear to be influenced by what he has been told about ICT benefits to his teaching and because he has not implemented these ideas, he

struggles even in his espoused practice to substantiate the value he assigns to his usage. In his enacted practice, Takalani does not demonstrate the value he claims in his espoused practice as he completely relies on his verbal narration in the learning activity. Because his type of learner engagement does not elicit meaningful feedback from learners by creating the right conditions for the correct answers he gets, it becomes difficult to tell if usage is of benefit to learning. In his espoused practice he shows that he does not know what to do with the feedback anywhere and this is reflected in his enacted practice as he does not use the feedback to enhance learner understandings.

b) Belief about ICT use

Moruti, the second geography teacher is also aware of the benefits of using ICTs, but in his espoused practice, there is resistance to give 'power' or credit to digital technology. As the ICT coordinator in the school, he seems to be aware of the policy content and his arguments could be his response to it. As an experienced teacher, Moruti is aware of good teaching that comes as a result of experience and emphatically objects to the 'mystical' promotion of ICTs in education. Whereas he is aware of the benefits of ICTs, it is possible that his learners get bored with his integration because the design of materials he uses is not engaging. The other reason could be that the linear approach he uses in his actual teaching makes the presence of ICTs of little or no value to the learning experience. For instance viewing one slide with a map representation of the content is not appealing anywhere especially if the conversation does not actively and meaningfully engage with it as is in his case.

c) ICTs perceived as production tools

The practices' incoherence in the case of the physical science teacher, Mshini could be related to his fundamental belief about the value he apportions to ICTs as a teaching tool. His belief that digital technology has abilities that he does not have (like all teachers in a way) is not closely linked to learning needs and as a result his usage is distanced from providing pedagogical value. In his response, Mshini only talks about ICT as a productive tool, (drawing many diagrams, covering more content, etc.) and does not explain how that is of benefit to the learning process. This anomaly seems to have an impact in his enacted practice as he leaves it in the background while he continues with his conventional teaching. It is possible that the extent to which he engages the technology in his actual teaching is determined by his need for that mechanical touch which he probably does not need for this particular lesson. This teacher is self-trained and has probably not seen other models of ICT use. His enacted practice could be constrained by his limited knowledge and skills about ICTs.

Conclusion

While Ertmer (2001) recommends that ICTs be introduced by identifying most immediate teacher needs, if these are not associated with enhancing learner cognitive engagement, using them might be at the expense of improving quality in education. What is emerging in the case of the township secondary school teachers in this study is that once pedagogical value is the key motive for using ICTs, usage tends to be consistent with the espoused practices. Failure to make explicit what it is that is being enhanced by ICTs before they are engaged creates a gap between policy and its implementation. Through this study Laurillard's (2012:5) argument below is confirmed.

> We cannot challenge the technology to serve the needs of education until we know what we want from it. We have to articulate what it means to teach well, what the principles of designing good teaching are, and how these will enable learners to learn. Until then we risk continuing to be technology-led.

In the interest of this study, it is important that the principles be based on subject policy imperatives if engagement with technology will be of pedagogical value and promote effective integration of ICTs.

Having discussed issues around teacher espoused and enacted practices and how the policy and other issues could be responsible for the differences highlighted in the teacher integration of ICTs, this study will now attempt to define the outcomes of these discrepancies by presenting the types of integration that seem to emerge from this analysis.

3. Types of ICT integration

The categorisation that is used here is based on how each teacher is branded based on how the analytical framework and the analyses so far presents them. It is also based on the teachers' pedagogical value they portray in their ICT use. The categories take into consideration what seems to be responsible for the teachers' situation in the relationship between their espoused and enacted practices. They are as follows:

Mechanical

In this case, ICTs are portrayed as mechanical tools that enable the teacher to go beyond what a human being can do. The integration levels are low and this could be associated with not seeing the need for their use where the teacher is managing without them. On the other hand, this study does not necessarily advocate for frequent ICT integration but that whenever it is used, it be used to bring pedagogical value to the teaching and learning experience.

Convenience

The teacher seems to value the benefit the ICT contributes to his teaching for its immediacy affordance. Although this motivation might be driven by contextual issues, this seems to overshadow other teaching principles that could actually make his ICT usage of value in the enhancement of teaching this subject. The curriculum has already highlighted in Chapter 6 that this subject needs intervention. That demands flexibility on the part of the teacher in the use of technology in order to create a learning environment that promotes acquisition of this second language. The teacher's inflexibility as he rushes through the slides and large content seems to reduce learner chances of learning the language efficiently.

Insubstantial

The teacher seems to be aware of the benefits ICTs can bring to his teaching, but because he has not experienced these through his teaching, he struggles to substantiate them. Webb (2005) enlightens on this case by stating that the perception of affordances depends on information available and the person's disposition. In his actual teaching, he does not apply the use of 'visuals' that he values for learner understanding and retention of knowledge. This alludes to Riel and Becker's (2000) view that if beliefs about the technology are limited, the result is limited use. As demonstrated in his enacted practice, he is unable to utilise automated assessment results to improve and extend learning. Laurillard (2012:5) advises that such issues should be resolved before ICTs are engaged otherwise "we risk continuing to be technology-led".

Process oriented

This teacher values ICT use for facilitating learner understanding of problem solving processes that are intricate in this subject because of its reliance on the use of symbols. His ability to manipulate ICTs as a programmer enables him to program technology so that learners visualise and by so doing concretise the abstract concepts in this subject. In his attempt to make the process explicit, the teacher does not only rely on his materials design, but engages other teaching strategies to close gaps created by the structure presented with the technology.

Partnership

The teacher values his use of ICT for the partnership that exists between them. There is a consistent interchange of teaching slots that all contribute to the learners' empowerment in using mathematical language and in being exposed to different problem solving methods. The learners' understanding

of mathematical concepts and thinking is enhanced as each partner sufficiently and effectively (and yet not equally) plays his role in the learning process.

Teaching champion

In this case, the teacher promotes teaching as a noble profession and he seems to fear that ICTs could be taking away its value and integrity. This is a surprise, as this teacher has had over twenty years of ICT usage. In the five of those, he has been using it for teaching and the expectation would be that he would promote its use at the level of the policy understanding. His use does not tally with his experience with ICTs but rather his experience as a teacher who still upholds his style of teaching. This seems to refute Mueller et al.'s (2008) assertion that "teacher's pedagogical philosophy may be altered following the integration of computer integration". His teaching philosophy has not changed much, regardless his long use of the technology.

Collective

In this case Bambisana demonstrates how ICTs can be integrated into conventional teaching as she shows how different teaching technologies (digital and non-digital) can support each other in helping learners adapt to new understandings. She brought in the strengths of each to enhance understanding of learner concept development. This style of teaching seems cumbersome and would need good preparation. Its benefits to the learning experience though are significant.

Conclusion

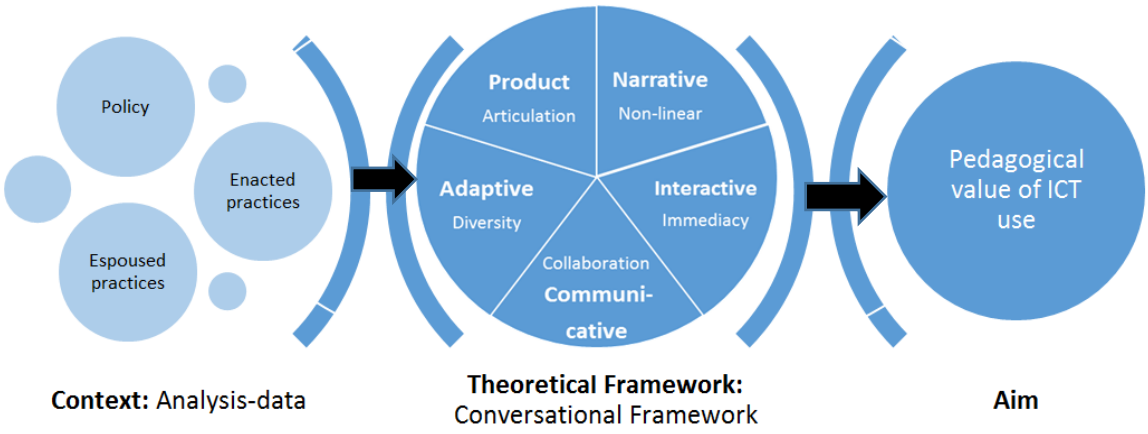
While the identification of ICT integration types is useful in developing an intervention for teacher training, it would need further categorisation so that it meets a group of teachers with similar needs in terms of espoused and enacted practices. In the case of South Africa where offering technical skills has been used to prepare teachers for ICT pedagogical integration, subject specific training would be more ideal if findings from the 'coherence of classroom practice' in the previous section are to be relied on. With these integration types, teacher needs and strengths in their specific subjects can be identified and addressed in training them on how to enhance their classroom conversation.

In the next section, this study discusses ICT integration aspects that emerge from the seven teachers under study that need to be considered when thinking about how South African teachers can be prepared for a successful implementation of ICT pedagogical integration.

4. Classroom practice requirements for ICT integration

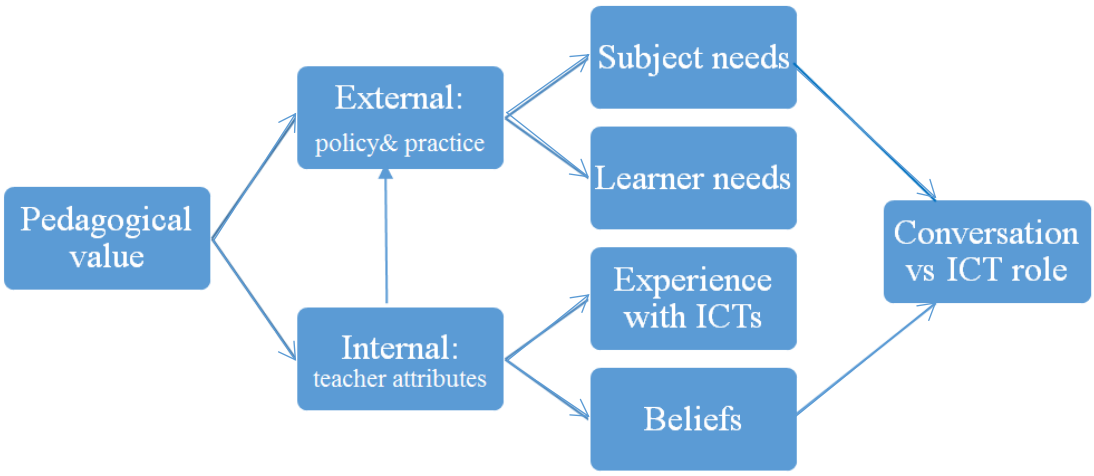
The purpose of this study is to use the interpretation of the seven teachers' practices and the policy document analysis to identify what can be used to inform the development of an ICT teacher training framework for South African teachers regardless their teaching context. It is for that reason that it has attempted to bring focus to the actual teaching and how ICT value can be realised and utilised in a way that can improve learning and teaching. This study is deliberately excluding teacher skills because the framework to be developed is for teachers with operational skills at any level. What is important is that teachers know what to pay attention to whenever they decide to integrate ICTs into their teaching regardless their level of ICT literacy skills.

This study has categorised classroom practice characteristics into internal needs (those that directly involve the teacher) and external needs (those that involve teacher knowledge).
At this stage the study reverts to the initial concern in the conceptual framework in Figure 2.1 as illustrated below.



This conceptual framework has helped identify what is and what is not of pedagogical value in the use of ICTs by the seven teachers in this study. It has gone through all the stages and processes in the framework and at this stage the focus is on the Pedagogical Value of ICTs. The focus now is on the themes that have emerged from the patterns that seem to be of influence to the quality of this product. The figure below illustrates these themes which form aspects about teaching and learning, based on the finding from teachers in this study that seem to be of significance in the integration of ICTs by South African township secondary school teachers.

Figure 8.1: Aspects about teaching and learning



If ICTs are to bring pedagogical value to teaching, the external elements about teaching and learning need to be acquired by the teacher from the policy framework and professional training. In addition, the internal factors which are inherent to the teacher contribute to supporting the effort made in the external components. These factors become influential in the act of teaching and they seem to determine the role played by ICTs in enhancing the conversation.

External Factors

It is paramount that teachers have knowledge about the subject needs through policy (what they should teach, its form, purpose to teach it and how to go about teaching it) and practice (what it takes to make learning happen, that is, the mediation process). This constitutes what Shulman (1986) considers as the pedagogical content knowledge (PCK). For teachers to engage in the Conversational Framework, they need to have these knowledge domains to meaningfully stir the learning activities in a way that can give birth to learning (Rothkopf, 1970). That makes up the ideal classroom conversation, which we believe will make learning possible. Based on this study's view, ICT pedagogical integration should be such that they support, not as an add-on, but ingredients that make up that which makes learning happen. This must not be looked at with an intention to give ICTs the same weighting as PCK but its significance should be in the difference it makes as it participates in the performance. This study accentuates the role of the teacher in ensuring the role that the technology plays is significant and yet invisible (Wenger, 1990). Such an understanding would then help identify and engage an ICT affordance that help teachers alleviate their incapacity (for instance, the case of Mlingani and the video) in achieving their teaching and learning goals. This is what this study considers as 'supporting' the Conversational Framework (Laurillard, 2002) and 'supporting normal teaching' by the White Paper on e-Education, (DoE, 2004). Having said that, effectiveness does not automatically follow, but decisions on

- why it is being engaged (subject need),
- in which part of the learning activity (in the Conversational Framework),
- as what media form and affordance, and
- specifically which pedagogical value the teacher wants to gain by the usage and
- what teaching strategies and non-digital technologies would help support the experience (for instance exercise books in the case of Mpetha).

It is important that as these decisions are made, the teacher bears in mind what learner needs are, as the level of engagement should be at the level of learner understanding. That determines what aspect of the syllabus to be taught and which ICT affordance can help achieve the curriculum goals. In the case of Mlingani, he knows well what his learner needs are and although he does not have advanced computer skills, he is able to use the video to improve learner mathematical language and develop their thinking skills. Mpetha contextualises learner needs by not only providing them with the appropriate knowledge, but skills they need to operate ICTs for their learning. He believes this is important for learners in a technical secondary school to acquire. By so doing he also empowers them with skills they will need after school to survive in an information society. On the other hand, when learner needs are not on the fore as in the case of Sizakele, technology tends to give the teacher the urge to cover more content. The urge could also be as a result of meeting curriculum deadlines. In such a case, the purpose of the integration process is not so significant to the learning experience (the cognitive process) but to satisfying external (policy) needs. Perhaps forming partnerships with the technology as Mlingane does and sharing responsibilities could still present ICTs as constituents in this one unit that seeks to achieve learning goals.

Once that is established, teachers need to decide on what role ICTs will play, to avoid minimal utilisation. For instance, in the case of Mlingani, Mpetha, Sizakele and Moruti they are clear with the narrative media form's role to present structure. It is also important to be aware of what the weaknesses are about media affordances and plan to integrate other resources in their place. Although Mlingani partners with the video, he knows that his learners might not understand the language used to present structure and he interprets the terms and gives examples as he works on the chalkboard to help them follow and to extend their understandings. His role is to interpret the structure while the technology's role is to present the basic structure. In the case of Mpetha, he is aware of his inability to verbalise mathematical processes and for that reason, he manipulates technology so that it concretises the abstract ideas words cannot adequately express. His other role is to detect learner misconceptions through their feedback during the development of the concept

which he uses to decide when and how to use the technology. He does not only verbalise the interpretation but also uses the ICT and other teaching strategies. On the other hand Bambisana engages 3 and 2 dimensional, pictures, drawings demonstrations to interpret structure.

In creating the learning environment, teachers need to be aware of materials design principles that can help draw learners' attention as they engage with the content. While Mpetha (the programmer) says he changes his presentation format every day, the teaching strategy is key in holding attention and above that in making clear the concept taught. Soule (2003) challenges this view as this effect is no guarantee that learners are learning better. Mlingani frequently though strategically alternates with the video and makes links to extend their learner understanding. Bambisana also uses the materials as they are but engages other technologies that she uses to give more detail in his explanations of the representations projected from the ICT. It seems therefore that it is the non-linearity that keeps learners attentive and motivated as well and this is at the discretion of the teacher. Moruti's testimony for instance confirms this notion as he says learners become passive to the extent that he has to engage interactive methods to draw their attention to the learning process. Consequently how materials are designed and how they are presented or integrated into the conversation is significant in enhancing the learning experience.

Although Mlingani appears to be as effective as Mpetha (the programmer), based on the findings from the analytical framework, his teaching could be influenced by the technology he claims he is partnering with. Although, Mpetha is aware of the materials' influence, Mlingani is probably unaware. What he is aware of is that since he started using the video, his matriculation pass average mark rose from 30% in the previous to 82% in his third year. Boyle and Cook (2004) confirm that technology can influence the way we live and eventually bring about a new way of living. In his enacted practice the researcher realised that the story telling strategy used in the video was also used by him to introduce the trigonometry topic and because it was at learner level, learners actively participated in the development of the lesson and they seemed to relate to it. On the other hand, Mpetha knows well what the disadvantages and advantages about the materials on the sponsor's software. The advantage that he commends is that the examples that are used relate to learner every day experiences and as a result he also does the same. In his enacted practice, he uses these examples to help establish his learners' understanding of the structure presented with technology. What needs to be pursued here is, what it takes for a teacher to learn from the technology. Is it the technology forcing its way into the teacher's way of teaching or it is the teacher that has observed or studied the affordance and therefore perceived it as having potential in enriching a particular component in his or her practice?

Internal factors

Internal aspects are those that pertain to teacher beliefs and attitudes (Ertmer:1999). These are teacher attributes that they possess within themselves. All teachers in this study believe ICTs add value to their teaching and yet the extent to which these are of influence to their enacted practices varies. Teachers whose beliefs about ICTs are aligned with the policy framework tend to enact them in their classrooms (Bambisana, Mlingani and Mpetha). On the other hand, teachers whose beliefs about ICTs do not reflect the policy imperatives fail to demonstrate the pedagogical value their use of the technologies bring to the development of learning.

Experience with ICTs for teaching is generally not a factor in the extent to which they integrate them into their teaching. For instance, three (Bambisana, Mlingani and Mpetha) of the seven teachers whose integration is aligned to the policy have had less than two years' experience. The other three (Sizakele, Takalani and Mshini have had the same experience and yet, because they do not maximise the use of ICTs in their classrooms. Of these three, Takalani seems to be affected by inexperience in the sense that he could not deepen or enact what he believes about the value ICTs bring to his teaching.

There is one teacher who should be considered as experienced in this study (Moruti) and yet his ICT pedagogical integration has been rated low. He confirms claims by Bingimlas (2009) and Howie and Blignaut (2009) amongst many other authors that experience and confidence facilitate effective ICT pedagogical integration. It seems rather, it is teacher attitudes and perceptions about ICTs that contribute to the extent to which they implement the integration process. It is the idea of separating ICTs and pedagogy in this case that seems to be the barrier. While the teacher (Moruti) for instance acknowledges that ICTs are part of the process, he seems to be disturbed by the fact that they are given more prominence and yet he knows well that they cannot 'replace' what the teacher can do. Crook (1994:79) attempts to make this point clearer by pointing out that computer-based instruction is "brittle and inflexible" and for that reason he argues that "comprehensive computer-based modelling of such (instructional dialogue) interactions is not realistic enterprise". He also points out that teaching is not just knowing facts and rules and because computers cannot think, they cannot reproduce the role of the teacher. The point that Moruti misses though is how his decision as the teacher can actually make the contribution of ICTs enrich his teaching. As long as he does not play his role in manipulating technology (a skill he seems to have or would not have a problem to learn) he deprives himself the pleasure of gaining much from his integration of ICTs into his already established and proficient practice. On the other hand, Mlingane, whose incorporation of ICTs into his pedagogy only requires him switching on, pausing and playing the

laptop, seems to benefit much from the process because his perception about the technology is positive, more so that he considers it to be having the potential to enhance his learner understanding. Takalani's experience is different, because although his attitude is 'very' positive, his enthusiasm seems not to translate to the ICT pedagogical integration advocated for in this study. There is not much indication, based on the CF and the analytic tool that the ICT's contribution brings value to the learning experience.

The internal factors discussed above all contribute to determining the roles played by the conversation and the ICT. What seems to be important is that the teacher whether with or without experience be aware of the specific role they play in enhancing their classroom conversation. In other words, a successful integration constitutes both internal and external factors.

Conclusion

Both external and internal factors contribute to the implementation of ICT pedagogical integration of ICTs. The is contrary to literature that claim teacher beliefs have a stronger influence on the extent to which ICT are integrated into teaching and learning (Ertmer et al. 2012). This study demonstrates how external factors do not just influence the uptake of ICT integration, but the formation and enactment of teacher beliefs. The seven teachers participating in this study all had more than three years of teaching experience and yet their interpretation of the concept under study and their policy compliance varied. The inconsistencies demonstrated through the role played by teacher and ICT show the importance of dealing with ICTs as part of pedagogy and not as a separate entity in the learning process.

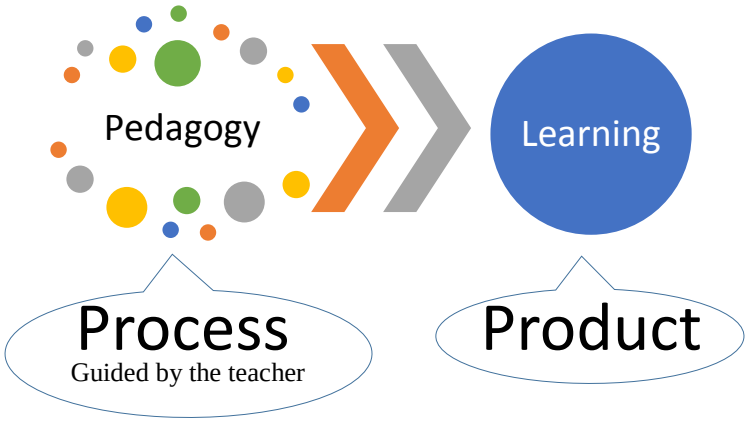
ICT pedagogical integration reviewed

The issue of roles has probably been over emphasised in the presentation of data regarding teacher practices and in the discussions. There is evidence that when the teacher does not take his position or authority as the teacher or the mediator in this integration process, the learning experience is weakened as in the case of Takalani. That means if the teacher takes his or her responsibility to create a learning environment (external process) with ICTs that promotes learner construction of understandings (internal process). Mpetha in particular, has made clear how not balancing the roles, but playing them (the roles) proficiently in the development of learner understanding brings value to the learning process.

It is therefore important to make the roles of that which makes learning happen (pedagogy) visible and that of ICTs to ensure each takes its rightful position in the integration process. That visibility

would consequently help show how digital technology enhances teaching and learning. The product of the process is learning and the process is pedagogy – a process that constitutes the consolidation of media forms, teaching methods and strategies. When ICTs are used, any of these constituents either enhance or they are enhanced by them. The figure below is an illustration of the interpretation of ICT pedagogical integration that emerges from the findings of this study.

Figure 8.2: ICT pedagogical integration



The graphic has deliberately not labelled the position of the ICT as it could be located anywhere in the realm of pedagogy. Where the ICT is engaged either as a narrative, interactive, communicative, adaptive or productive media, it is significantly (as the rest of the components) enhancing the process and promoting the generation of the product which is learning.

Examples of the reviewed ICT pedagogical integration

Through the examination of the three teachers whose ICT integration complied with the education policies, this study presents three ways of understanding what is happening in the pedagogy sphere of the Figure 8.2 above.

Example 1

In the case of Mpetha, the ICT role is that of providing structure for the concept taught. The teacher demonstrates how this whole process is at the mercy of the teacher as he explicitly and proficiently guides his learners towards reaching the learning goal. He extensively uses various teaching methods, strategies, together with ICT affordances to scaffold this process (See Chapter 5: Mpetha Enacted Practice). As he does so, Mpetha shows how the components support each other in the development of the concept understanding in a non-linear way.

Example 2

In the case of Mlingani, the roles played by the teacher and the ICT do not occur at the same time, but turns are taken in the development of the concept. The video takes less time (29.31%) in the interchange while the teacher spends more time teaching (69.62%) – explaining the structure provided by the video which he explains further by linking with other aspects of the topic, strengthening learner understanding of the subject language and carrying out tasks with the learners. The video is used to establish the learning and task goal. The links between the conversation and the ICT creates the 'whole' pedagogical object that qualifies to be described as the pedagogical integration of ICTs.

Example 3

The third scenario is that of Bambisana who clearly demonstrates how the integration of ICTs with other non-digital media forms in the 'process' enriches classroom conversation. In her case, the ICT can be represented by any component as it supports and is supported by other components in the pedagogy realm. The process is in the performance of all constituents as they work toward attaining the learning goal. The components can be a digital, non-digital or the teaching method.

Conclusion

The three examples demonstrate how ICT pedagogical integration can be interpreted in different ways by teachers at different levels of computer proficiency and yet use ICTs in a way that has pedagogical value. This is an indication that the teacher is the agent of change in this transformation.

Contribution of this study

While the extent to which the interaction advocated for in the CF was initially developed for university learners, this is not a given in South African secondary school learners in general. Where ICTs are used effectively, the quality of the interaction between learners and teachers in the lessons observed is enhanced. The enhancement is brought about by the concretisation of abstract processes (Mpetha), the exposure to different problem-solving methods (Mlingani) and making explicit different representational forms (Bambisana) through ICT use. In a South African schooling system therefore, it is the specific role the ICT is playing, how it is made to support the conversation and how the teacher synchronises this process that is critical in the effective use of digital technologies in the classroom. Ordinary Secondary school learners are not motivated to learn (Schulze and Steyn, 2007) and as Moruti exclaims, ICT use does not overcome this problem in his classroom. It is therefore the type of use, the type of materials designed and the type of synchronisation that

teachers effect in the process that determines success. The Conversational Framework offers a broad outlook to the classroom activities that lead to construction of knowledge and the elements that emerge from this study make explicit how it applies in South African classrooms as ICTs are integrated into subject teaching.

Although most township schools in the Gauteng province now have ICTs in schools, these do not have access to some of the software that Laurillard (2002) refers to in her description of media. However her descriptions of media forms and that of Conole and Dyke's (2004) ICT affordances help to translate pedagogical value to other teaching technologies that are able to yield the same educational benefits. This study has therefore helped to highlight the significance of the good aspects of teaching that are already happening in South African township classrooms (Bialobrzeska and Cohen, 2005). The lessons learnt from the participating teachers make plain the importance of the teacher in the role that ICTs play in the teaching and learning process. The absence of the latest and advanced technologies does not present a valid excuse for poor performance in South African schools with limited resources. Teachers should simply play their role as teachers and maximise the utilisation of the available technologies in their classrooms by identifying subject (policy) and learner needs and engaging whatever technical skills they have to enhance learning.

Although the policy framework is not considered by this study to be adequate as a workable account of ICT integration in the context of this study, the study has learnt from both positive and negative aspects of teacher classroom practices diverse as they are even in their compliance to it. This, as already been mentioned is made possible by the conversational framework and the analytical framework developed for this study. Through the discussion engaged in this study, there are issues that have emerged that can help inform the ICT teacher training for teachers in South Africa by adopting an ICT integration understanding that can help make teachers aware and interpret the jargon used in its policy to facilitate a productive implementation.

Although there has been a call from the South African government to go into the classroom (Blignaut, 2013) to try and understand what teachers are doing in the classroom, that has not been done to this extent where the key concept of driving the process is clearer for any teacher regardless what context they work from. It is hoped that this study will not only inform teacher beliefs about their practice but how they should engage digital technology to enhance their teaching. The government can benefit from this study by changing its current technical-based intervention strategies to those focused on empowering teachers for better teaching with ICTs.

Limitations

It was difficult to identify a model that could be used in the context that the researcher was working from as available ICT pedagogical integration models are developed from developed countries with affluent digital resources. The theory eventually adopted did not completely relate to township experiences, especially in the examples and descriptions of media forms. Although the CF is relevant to any classroom, some of the descriptions are limited in terms of making explicit what alternatives can be adopted in cases where there is a single technology in the classrooms. This challenge called for innovation in its implementation that took time to figure out especially in its integration in the development of the analytical framework. The interpretation of the data with such variables was not easy, considering that the same phenomenon (value in ICT pedagogical integration) had to be identified and linked with each teacher's espoused and enacted practice, and the four policies. However, responses from PhD weekends presentations, writing retreat readers, fellow PhD students, colleague input and regular guidance from my supervisor was of great help in bringing and keep the focus to the purpose of the study. At some point, the researcher struggled with interpreting data from a teacher and she had to solicit clarity from the (CF) theorist, Laurillard who was very helpful in clearing the mist through an email correspondence. Although this sample might be considered small to make the conclusions made, the criteria used was guided by intentions for the study and to reduce it to this number. Time and effort was made to check if the participants were what the study needed in order to get the best possible explanations (von Wright in Stake, (2000) for value in ICT pedagogical integration. Because the interpretation of the concept ICT pedagogical integration was not so clear to the researcher, this resulted in the delay in making decisions on how to interpret data in the context of the framework. However, the interpretation exercise with guidance from literature helped in the understanding of the concept and how it applied in the teachers' practices.

Proposal for further study

While this study has identified areas that need to be considered when preparing teachers for a successful integration process through its pursuit for value in the ICT pedagogical integration of teachers in the township schools, there is a need to focus the study on specific subjects if teachers will get assistance that speaks to their needs in the classroom. Although this study has suggested different types of integration, it is possible that the broader sample, incorporating different geographical and socio-economic locations would identify more that are more relevant to the specific contexts. These can also be collated to facilitate the development of a more generic framework.

Conclusion

While the constructivists' theories have attempted to give direction on how learning happens internally and externally, what this study needed from it is how that can be observed and described. Laurillard's (2002) Conversational Framework has helped to make that explicit, by so doing making it possible to detect the value ICTs bring to the learning process. It is this visibility that has helped this study to have a deeper and yet clearer meaning of what ICT pedagogical integration entails in South African township secondary school classrooms.

Final Word

It is hoped that this study has been successful in exposing the 'elephant in the room' – the teacher (Dron, 2012). The introduction of digital technology into the field of education has placed the tool at a pedestal at the expense of the teacher who is the agent to learning. This has led to many teachers fumbling with these tools after being disarmed by the delusion that it is the technology that enhances their teaching. It is not. The teacher enhances learning by not just teaching with ICTs, but through integrating it into his or her teaching - that which already exists. Teacher training programmes therefore need to go beyond provisioning of computer basic skills and preparing teachers on how to enhance classroom conversation with ICTs. As long as the programmes continue to present ICTs as separate entities in the pedagogical ensemble, teachers will continue to under-utilise these powerful technologies to enhance teaching and learning.

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Appendices

Appendix A: Consent Forms

A.1 School Consent Form

Dear Sir

I am a PhD student at Wits School of Education who is currently registered at the University of the Witwatersrand. I would like to seek your permission to carry out an action research in your school in the field of Information and Communication Technology in Education (ICTiE). The title for my research is: Integration of ICTs into Subject Teaching: a case study of five teachers in a South African township secondary school.

It is the concern of this study that teachers in schools with ICTs are not maximising the use of these technologies to enhance learners' performance as the White Paper on e-Education (2004) advocates. These gadgets are mostly used for lesson preparation, recording marks and for typing learner handouts and tests. The use of ICTs in the classroom is usually limited to PowerPoint presentations and to carry out calculations related to subject content. This research seeks to find out the extent to which teachers in your school use digital technologies to develop higher-order thinking skills to facilitate improvement in learner performance in at least five different subjects. An intervention strategy to improve ICT pedagogical integration into subject teaching in your school will hopefully be developed, and its effectiveness will also be evaluated. The framework can be used by the rest of the school and any Department of Education interested in developing ICT pedagogical integration into subject teaching.

If permission is granted, five teachers teaching different subjects to the same grade in the senior phase preferably will voluntarily participate in this study. They should be presently using ICTs to teach and willing to participate throughout the duration of the study. The learners in their classes will also be involved during lesson presentations and their participation will be videotaped to capture everything that might be responsible for the level at which they perform whether orally or in written form. The technical assistant will freely attend these lessons, in case his or her service is needed. Consent forms for the teachers, technical assistant and parents of learners participating will be issued and signed before the research begins. I will conduct interviews and work collaboratively with the teachers before, during and after the study.

I intend carrying out the research during the second term when consent has been granted from all involved. The interviews will be conducted after school or whenever the teachers are available and

they should not last more than 30 minutes per session. These will be audio recorded. Three lessons per teacher, before the intervention, during and afterwards will be observed and videotaped. The data collected will be discarded after five years. In order to protect your school and the participant's confidentiality, pseudo names will be used in the presentation of this report. I will also assure them that their participation in this research is voluntary and they may withdraw their involvement at any time without affecting their reputation as employees in this school.

I promise that I will make this report available to you for scrutiny before it is published should you wish and present you with a copy on its publication.

I would be grateful if you would sign and return the slip below at your earliest convenience.

I enclose two copies of this letter. Please keep one for your files.

Yours sincerely

_____

Nokulunga Sithabile Ndlovu

Office Number: 011 717 3077 Cell Number: 082 220 0448

Email address: nokulunga.ndlovu@wits.ac.za

I, _____ (principal) give my permission for Nokulunga Sithabile Ndlovu to undertake her research in the school and in the classrooms of the five teachers who will participate in her study.

_____ _____

Principal's Signature Date

_____Principal's Name

A.2

Teacher Consent Forms

Teacher Informed Consent Form

I, _____ (teacher) give consent for Nokulunga Sithabile Ndlovu to involve me in her research that seeks to improve ICT pedagogical integration into subject teaching. I am voluntarily offering to participate in her study during audio recorded individual and group interviews. I will also allow her to take video recordings during my lessons and offer her teaching and learning material to enable her to collect comprehensive data that will facilitate better understanding of how ICTs can be used to develop higher-order thinking skills.

I am aware that I can withdraw my participation or materials from the research and that my withdrawal will not impinge on my employment in this school. I have been informed that pseudo names will be used in the report to protect my confidentiality and that the data collected will be discarded after five years

_____ _____

Teacher's Signature Date

_____

Teacher's Name

A.3

Technical Assistant Informed Consent Form

I, _____ (technical assistant) give consent for Nokulunga Sithabile Ndlovu to involve me in her research that seeks to improve ICT pedagogical integration into subject teaching. I am voluntarily offering to participate in her study during audio recorded individual and group interviews. I will also allow her to capture my activities in the video recordings during observed lessons to enable her to collect comprehensive data that will facilitate better understanding of how ICTs can be used to develop higher-order thinking skills.

I am aware that I can withdraw my participation from the research and that my withdrawal will not impinge on my employment in this school. I have been informed that pseudo names will be used in the report to protect my confidentiality and that the data collected will be discarded after five years

_____ _____

Technical Assistant's Signature Date

_____

Technical Assistant's Name

A.4

Parent Consent Form

Parent Informed Consent Form

I, _____ (parent) give consent for Nokulunga Sithabile Ndlovu to involve my child _____ (child's name) in her research that seeks to improve ICT pedagogical integration into subject teaching. I am allowing her to capture my child as she participates in the lessons that will be videotaped during the observed lessons to enable her to collect comprehensive data that will facilitate better understanding of how ICTs can be used to develop higher-order thinking skills.

I am aware that I can withdraw my child's participation or materials from the research and that my withdrawal will not impinge on my child's participation in this school. I have been informed that pseudo names will be used in the report to protect my child's confidentiality and that the data collected will be discarded after five years

_____ _____

Parent's Signature Date

_____

Parent's Name

Appendix B: Clearance

B.1 University of the Witwatersrand Ethics Clearance

Wits School of Education

27 St Andrews Road, Parktown, Johannesburg, 2193 Private Bag 3, Wits 2050, South Africa
Tel: +27 11 717-3064 Fax: +27 11 717-3100 E-mail: enquiries@educ.wits.ac.za Website: www.wits.ac.za

Student Number:
0618698K
Protocol Number:
2012ECE062

Date: 04-Sep-2012

Dear Nokulunga Ndlovu

Application for Ethics Clearance: Doctor Of Philosophy

Thank you very much for your ethics application. The Ethics Committee in Education of the Faculty of Humanities, acting on behalf of the Senate has considered your application for ethics clearance for your proposal entitled:

Integration of ICTs into subject teaching: a case study of five teachers in a South African township secondary school

The committee recently met and I am pleased to inform you that clearance was granted. The committee was delighted about the ways in which you have taken care of and given consideration to the ethical dimensions of your research project. Congratulations to you and your supervisor!

Please use the above protocol number in all correspondence to the relevant research parties (schools, parents, learners etc.) and include it in your research report or project on the title page.

The Protocol Number above should be submitted to the Graduate Studies in Education Committee upon submission of your final research report.

All the best with your research project.

Yours sincerely

M Mabeta

Matsie Mabeta
Wits School of Education

011 717 3416
Cc Supervisor: Dr. D Lawrence

B.2 Gauteng Department of Education Clearance

education
Department: Education
GAUTENG PROVINCE

For administrative use:
Reference no. D2012/239

GDE RESEARCH APPROVAL LETTER

Date:	**15 March 2012**
Validity of research Approval:	**15 March 2012 to 30 September 2012**
Name of Researcher:	**Ndlovu N.S.**
Address of Researcher:	**160**
	9th Avenue
	Highlands North
	2192
Telephone Number:	**011 400 0072 / 082 220 0448**
Email address:	**nokulunga.ndlovu@wits.ac.za**
Research Topic:	**Integration of ICTs into subject teaching: A Case study of five teachers in a South African township secondary school**
Number and type of schools:	**ONE Secondary School**
District/s/HO	**Ekurhuleni East**

Re: Approval in Respect of Request to Conduct Research

This letter serves to indicate that approval is hereby granted to the above-mentioned researcher to proceed with research in respect of the study indicated above. The onus rests with the researcher to negotiate appropriate and relevant time schedules with the school/s and/or offices involved to conduct the research. A separate copy of this letter must be presented to both the School (both Principal and SGB) and the District/Head Office Senior Manager confirming that permission has been granted for the research to be conducted.

The following conditions apply to GDE research. The researcher may proceed with the above study subject to the conditions listed below being met. Approval may be withdrawn should any of the conditions listed below be flouted:

1. *The District/Head Office Senior Manager/s concerned must be presented with a copy of this letter that would indicate that the said researcher/s has/have been granted permission from the Gauteng Department of Education to conduct the research study.*
2. *The District/Head Office Senior Manager/s must be approached separately, and in writing, for permission to involve District/Head Office Officials in the project.*

1

Making education a societal priority

Office of the Director: Knowledge Management and Research
9th Floor, 111 Commissioner Street, Johannesburg, 2001
P.O. Box 7710, Johannesburg, 2000 Tel: (011) 355 0506
Email: David.Makhado@gauteng.gov.za
Website: www.education.gpg.gov.za

Appendix C: Interview Schedule

Individual Teacher Interview Questions

Title: Integration of ICTs into Subject teaching: a case study of five teachers in a South African township secondary school

Section A

1. What subject do you teach?
2. What ICTs are you able to access from the school?
3. Which ICTs do you use in your teaching? When and how do you use them?
4. What constraints have you experienced when using ICTs to teach?
5. Is technical assistance available during your lesson presentations? If so, how effective is it to the smooth running of your lesson?

Section B

6. What do you think ICT integration into teaching and learning of your subject mean?
7. Where and when do you find the use of ICTs most productive in your teaching?
8. Have you identified any improvement in your learners' performance since you used ICTs to teach? Explain your answer.
9. What do you attribute to the improvement or lack of improvement to your learners' performance since you used ICTs to teach?
10. What do you think higher-order thinking skills are?
11. How do you develop these skills in your subject teaching with and without ICTs?

Section C

12. Do you prepare your ICT integrated lessons on your own? How do you find it?
13. Do you feel you are adequately prepared to integrate ICTs into your teaching?
14. What additional skills or knowledge would you need if you were to integrate ICTs into your teaching effectively?

Appendix D: Reliability Instrument

Number 1-2 are the steps followed to arrive at the result

1. **Format for coding of Mpetha's interview by Monica Dzinotyiweyi**

No.	Color code	Media form	Affordance	Evidence
1		Narrative	Non-linearity	Multi-modality
2		Interactive	Immediacy	Feedback
3		Communicative	Discussion	class/group
4		Adaptive	Reproduction/Experiment	role-play/concretising theory/ practice
5		Productive	Product	knowledge construction

2. **Coding of Mpetha's interview by Monica Dzinotyiweyi and Nokulunga Ndlovu**

Note: The numbers 1-5 represent each color code. '0' stands for a disagreement. The extracts selected generally represent Monica's coding which was coherent, reflecting her understanding of the analytic tool.

Text Coded	**Monica**	**Nokulunga (Researcher)**
Learners, on their own, they are able to access the content in their cell phones, but that content, I have taken it from the ibox and upload it to the website where they can be able to download.	1	0
For assessment we use the clickers. For assessment we design different questions then we programe them on the ibox so that the class will be able to respond,	2	2
They have become free to ask because they are seeing a learner so they end up having arguments to say no you can't do this, you can't do this because it's a learner.	3	3
But if we say, the average marks of your test that you have written or your marks for first term – you add and divide with the total of the tasks it becomes much easier. And this is much based on the technology they are using. They want to say learners must be familiar with what they are learning in the environment that they are living in, they must identify Maths things inside that.	4	4
In terms of maths teaching they are able to teach others. They can just come and say we are asking for the ibox, there is something I want to show my friend.	5	5
Percentage	**Agreement: 80%**	

Comment: Monica's coding of the Narrative media tended to relate to access issues that were not the main focus in this study, but how learning and teaching was enhanced through the access. In other words what she seemed to select were issues that magnify the mere presence of technology and not how it was used in the classroom.