ACCESS AND USE OF INFORMATION AND COMMUNICATION TECHNOLOGY FOR TEACHING AND LEARNING AMONGST SCHOOLS IN UNDER RESOURCED COMMUNITIES IN THE WESTERN CAPE, SOUTH AFRICA

by

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DECLARATION

I, Kesewaa Koranteng, declare that "**Access and use of information and communication technology for teaching and learning amongst schools in under resourced communities in the western cape, South Africa"** represent my own unaided work, and that it has not previously been submitted for academic examination towards any qualification. Furthermore, it represents my own opinions and not necessarily those of the Cape Peninsula University of Technology.

Signed **Date**

ABSTRACT

Due to the legacy of apartheid South Africa is facing developmental discrepancies with inequalities between the advantaged few in the more urban areas and the disadvantaged majority in the rural areas. With quality education being key, not only to the success of an individual but of a country's development, efforts have been made to ensure equal access for all. ICT is seen as a key enabler to this end. The study investigated the status of ICT deployment and its integration into curricula in schools. The objective was to understand the factors affecting the efforts to achieve successful implementation of ICT integration into schools in underdeveloped areas, to understand the challenges that exist and ultimately, to inform solutions.

A qualitative study was conducted, using a case study method. A purposive sampling method was used to select population elements; educators and school coordinators of ICT programs in Western Cape schools (i.e. Kulani Secondary, Sithembele Matiso Secondary, Macassar Secondary and Marvin Park Primary). To gain an understanding of the status quo, literature was explored and semi-structured interviews were conducted with ICT coordinators and educators within the 4 sampled schools.

Activity theory was used to provide an analytical framework for the study. Through this framework the aims and objectives of the study were conceptualized and summarized to form a graphical representation of the phenomena under study.

In spite of efforts to ensure universal access to ICT, the findings indicate that the status of ICT deployment and its integration into school curricula is far from favourable in underdeveloped schools. With regards to physical deployment, the number of learners per computer among the 4 sampled schools did not meet the ideal standard of 1 learner per computer nor the one set by developed countries of 5 learners per computer. In terms of the status of ICT integration into school curricula, the findings indicated that very few subjects had a computer facilitated aspect. Finally on the status of ICT skills amongst educators, the findings showed that most educators were only given basic computer literacy training. Consequently very few educators were teaching using ICT.

Inequalities in the access to ICT for teaching and learning need to be addressed. A continuation of the status quo can negatively impact governmental efforts to ensure universal access to ICT and its integration into school curricula. For example, with the deployment of ICT into schools the findings indicate a disappointing status with the main causal factors being a lack of finance, poor ICT resource coordination and a lack of technical support. Authorities and private

organizations are therefore advised to revise the efforts made to deploy ICT into schools and possibly have personnel to audit the process, including the funding model. Aside from the financial limitations there appears to be a clear lack of common understanding between school communities and policy makers. In response to this situation, this thesis draws on the Work Activity Framework in Figure 2 to recommend a revised communication process between the national, provincial and local (school) coordinators on the full details of ICT deployment in schools.

Considering the full integration of ICT into the school curricula, findings show that very few subjects within the sampled schools had a computer facilitated aspect. The causal factors for this poor status were a lack of relevant ICT and educational software. Therefore this thesis recommends that authorities should make certain that e-Schools coordinators liaise with the schools to ensure that money allocated for the schools is received by the schools and that it is used for the acquisition of ICT resources. There also appears to be a lack of clear guidelines for implementation. Therefore the framework (Figure 2) proposes that educational authorities should ensure that the motives for this goal are clear and also provide well defined guidelines for the implementation processes.

In terms of ICT teacher skills, the findings indicate that most teachers were only given basic computer literacy training which was inadequate. Therefore the thesis recommends that, educational authorities should invest in teacher training programs and ensure that competent facilitators are appointed to train educators. Also the training programs provided should be revised and focus should be on training teachers on how to fully integrate ICT into curriculum.

Key words: ICT Integration, ICT Deployment, Computer -based programs, ICT, ICT literacy
ICT Access, Disadvantaged Schools, Under-resourced communities

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ABBREVIATIONS

ANT	-	Actor Network Theory
AOL	-	American Online
ARPA	-	Advanced Research Projects Agency
ASEAN	-	Association of Southeast Asian Nations
AT	-	Activity Theory
CompTia	-	Computing Technology Industry Association
CPUT	-	Cape Peninsula University of Technology
DoC	-	Departments of Communications
DoE	-	Department of Education
DST	-	Department of Science and Technology
DUT	-	Durban University of Technology
GeSCI	-	Global e-Schools Communities Initiative
ICT	-	Information and Communication Technology
INTEL	-	Integrated Electronics
IS	-	Information Systems
KEWL	-	Knowledge Environment for Web-based Learning
LMS	-	Learning Management Systems
MDGs	-	Millennium Development Goals
NEPAD	-	New Partnership for African Development
NGO	-	Non-Governmental Organizations
NMMU	-	Nelson Mandela Metropolitan University
OLPC	-	One Laptop Per Child
SCOPE	-	South African-Finnish Co-operation Programme in the Education Sector
SMS	-	Supported Text Messaging
ST	-	Structuration Theory
TLI	-	Teacher Laptop Initiative
UNESCO	-	United Nations Educational, Science and Cultural Organization
USAASA	-	Universal Service and Access Agency of South Africa
WWW	-	Word Wide Web

DEDICATION

This thesis is dedicated to my family: Isaac, Florence, Kweku and Akose Koranteng.

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CHAPTER ONE: INTRODUCTION

Whilst the industrial economy of the 20th century was defined by the ideological contests between the capitalist west and the communist eastern blocks, the knowledge economy of the 21st century is defined by the new technology-based innovations, which are centred on knowledge, information efficiencies, and literacy/ies.

A technology-driven innovation is a function of scientific discoveries based on knowledge accumulated over time (Morris, 2006). The link between scientific discoveries and knowledge in this statement, suggests the presence of some systematic and innovative activity/ies that give rise to further technological advancements. An innovative activity thus, creates the opportunity to produce new or improved products and, as such, can be considered an implementation of scientific and technological know-how (Kriaucioniene, 2008).

Information and communication technology (ICT) and its continuous innovations have improved many efficiencies in modern day living. For example it has made governance effective and convenient through e-Government (Dwivedi & Bharti, 2005; Gupta, 2011). Through e-Commerce the process of buying and selling can be done in a cost effective and time saving manner (Goel, 2007). Furthermore equal access to quality education has been made possible through features such as e-Learning, educational software, World Wide Web (WWW) amongst others (Jhurree, 2005; Bunt-Kokhuis, 2012). The significance of e-Learning for the teaching and learning process is that it allows learning to be done anywhere and at anytime (Goi & Ng, 2009). Educational software aids in simplifying difficult concepts, makes learning fun and easy (Simkins *et al*., 2003). It also helps learners carry out practical tasks such as experiments, presentations etc. (*ibid*). With all the efficiencies of ICT and its continuous innovations for the teaching and learning process, it would be expected that all learners within South African schools would have access to and benefit from these efficiencies, however this is not the case. Full access to the benefits of ICT for teaching and learning is limited to the advantaged few in the more urban areas whilst learners in disadvantaged areas are robbed of the chances of gaining good quality education (Mlitwa & Nonyane, 2008; Nonyane, 2011). This can hinder them from advancing and improving their standards of living. This study seeks to understand the challenges encountered which affect the successful deployment of ICT in disadvantaged schools and its integration into the school curriculum together with the causal factors, so as to inform remedial efforts.

The chapter opens with examples of technology driven innovation in the sections 1.1.1 and 1.1.2. This is followed by a discussion of the World Wide Web (WWW) and its technology driven innovations for teaching and learning in the section 1.2. Next the background of the research

problem is presented in the (section 1.3), followed by the statement of the research problem and the research problem in the sections 1.4 and 1.5 respectively. The research assumptions are presented in the section 1.6. This is followed by the research questions and sub-questions in the sections 1.7 and 1.7.2 respectively. The research aims and objectives are presented in the sections 1.8 and 1.9 respectively. Next the research contributions, clarification of concepts and limitations to the study are then presented in sections 1.10, 1.11 and 1.12 respectively. A summary of the chapter is provided in the section 1.13. This is followed by the thesis structure in the section 1.14. The chapter concludes with the section 1.15.

1.1 New Technology Driven Innovations

New technology-based innovations over the last two decades have totally transformed and globalized the world economies, and have had a major impact on the quality of the modern life. Examples of the new innovations include developments in telecommunications and the increased networking of digital computing in the post cold-war era.

1.1.1 Advancements in Telecommunications

Starting with continuous improvements in telecommunications, the emergence of cellular phone technology in the 1980's marked an innovative advancement from the traditional fixed-line telephony, into mobile and flexible ways of telecommunicating (Rafig & Gao, 2008). The innovative phases of mobile phone technology can be categorized in terms of stages or generations, with each phase described by a related level of improvement in network standards, cost efficiency and performance. Starting with the first generation (1G) of mobile phones, this was an improvement in the sense that it offered mobility to the telephone services and users (Vlok, 2007). The transition into the second generation (2G) in 1990 (ibid) extended the capacity of the 1G development in that it also supported text messaging (SMS). Within this continuous pattern of developments and growth in new technologies, it did not take long for the 2G wireless telephony to be integrated with the new interactive multimedia technologies. This upgrade of the 2G capabilities enabled the leap from the 2G, to the third generation (3G) of mobile phones.

The 3G added numerous improvements to the previous generation of wireless phones, in many ways (Bhalla & Bhalla et al. 2010). It offered improvements in the network capacity, by enabling the transmission of larger quantities and more varieties of data (*ibid*). It also expanded the uses of a mobile phone: from being only used for the exchange of audio and text data, the phone was now transformed into a highly interactive, multi-faceted and multi-purpose communication tool (Sarrocco & Ypsilanti, 2007). Mobile phones at the post 3G level, allow for example mobile emailing, data streaming, video telephony, instant messaging and Internet access (Karjaluoto,

2006), to support interactive efficiencies. Below are more examples of new technology-based innovations.

1.1.2 Advancements in Networking and Digital Computing

Further examples of the new technology-based innovations can be seen in inter-networking and the incremental advancements of digital computing. The development of the Internet, from the Advanced Research Projects Agency (ARPA) Network of the US Department of Defence in 1969 (Leiner *et al*., 1997), is a case in point. This development was based on the idea of multiple networks that were not inter-connected to each other. With continuous innovations in interconnection technologies by the Internet pioneers such as Vinton Cerf, the inter-connection of multiple networks or inter-networking, became a possibility in 1973 (David, 2001).

The Internet, as it has been known since then, is based on open architecture networks where the choice of any individual network technology is selected freely by a provider and made to inter-connect with the other networks through a meta-level "inter-networking architecture" (Leiner *et al*., 1997). In this level of inter-networking however, the extent to which it was possible to access and exchange information was limited in terms of the quality, and the variety of data that could be accessed and exchanged between networks. As stated by Clark (2001), network applications were few, and limited to file transfers, Web access and email services, which functioned at a much slower rate than they do now. The extent of interconnectivity was also limited in terms of distance. That is, inter-connection was either between networks within a specific local area, or at most, between a number of local area networks – but interconnectivity was not on a world wide scale (Rosenzweig, 1999).

As a new technology advancement, the Word Wide Web (WWW) offered massive interconnectivity solutions to the original Internet. The WWW innovation expanded the Internet's infrastructure and protocols. Developed by Tim Berners-Lee in 1991, it extended the interconnectivity capacity of the original Internet, beyond the wide-area network boundaries, into worldwide levels of connectivity. This way, the WWW enabled information exchanges between networks, regardless of the area where information was stored, the method used to store this information, or the system used to manage it (Berners-Lee & Cailliau, 1992). It allowed access to a universe of online information, making it possible to share information between internationally dispersed groups of users, and for the creation and distribution of information by various support groups, across time and space (Berners-Lee, 1993).

In ways similar to the 3G mobile telephony benefits, the WWW has improved efficiencies in the management, storing and exchanges of information for the private, the social, the business, the

governance, and the educational aspects of modern life. Private individuals and groups (including organizations) for example, use the WWW-based Internet tools such as Weather Pulse 2.2, Weather Watcher Live 6.0 beta, etc, to access weather forecast (Informer Technologies, 2010), or use e-mail facilities to communicate with each other across time and physical space. Individuals also use multimedia technologies such as Flash for online entertainment games, and they use the Live Chat, msn messenger, AOL instant Software for chatting with friends (Kraut *et al*., 1999). Through the Internet it has also become possible to use the social interactive media (Markus, 1987) such as face-book (www.facebook.com), twitter (www.twitter.com), and computer conferencing tools for synchronous and asynchronous online social-networking[1] (Mislove *et al*., 2007). As a result, information exchanges and interactions between individuals and groups have become more convenient, faster and flexible than were possible in the pre-www forms of communication networks.

In what is known as electronic commerce (or e-Commerce), individuals or groups use the Internet to market, buy and sell commodities online (Andam, 2003), and without having to step outside their office or home. This way, time is saved whilst buyers are also spared the inconvenience of travelling, finding parking and even standing in long queues at payment tills. Businesses can also buy products from one or more suppliers and conclude a trade transaction with an online payment, without physically driving to different premises to effect payment (Laudon & Traver, 2007; Wlenclaw, 2008). The www-based Internet also offers new opportunities for government institutions and departments to enhance and improve their interactions with the public. Through electronic governance (or e-Governance) for example, the central, provincial or local government is able to use a www-portal to provide information on key services to the public. The advantage for the public is that instead of travelling to government offices that only open during office hours, citizens with knowledge and access to the Internet can now access government information at a mere press of the button (Mjuleni & Mlitwa, 2008). This in turn, can improve government accountability, transparency, effectiveness, public services delivery and citizen participation in decision-making (Backus, 2001).

1.2 The WWW and its Technology Driven Innovation for Teaching and Learning

The www-based Internet tools have also emerged as the critical enablers of teaching and learning processes in modern education. The web-based systems for example, can be used as a medium to connect learners and teachers, and to connect learners with expert support services. In education, the WWW is also seen as a resource and a tool to enhance teaching and

[1] Social networks are a group of Internet applications based on the ideological and technological foundations of the post Web 2.0 capabilities (Mislove *et al*., 2007).

learning processes. In electronic learning (e-Learning)[2], which is the main feature of e-Education[3] for example, the WWW enables a lecturer, with or without students, to create an online learning environment. The significance of the WWW in e-Learning then, is that of a facilitator and an enhancement of the distance and residential education in virtual spaces (*ibid*). In e-Learning, the WWW enables the use of learning management systems (LMS) to facilitate teaching and learning processes. LMS are discussed briefly in the following section 1.2.1.

1.2.1 Learning Management Systems

A Learning Management System (LMS) is a web-based platform, a virtual environment (Czerniewicz *et al.*, 2006), an interface between the lecturer, the learner and the classroom, as well as a tool to facilitate various aspects of the teaching and learning processes, online (Watson & Watson, 2007). As a WWW or web-based educational tool, an LMS incorporates various teaching, learning and administrative enablers, and it assists teachers in delivering courses over an online platform (Kinshuk *et al*., 2003; Cohen & Nycz, 2006; Georgouli *et al*., 2008).

As a teaching and an administrative enabler, an LMS can be used by educators to plan and publish tasks for learners, schedule teaching assignments and manage learner assessments. It also enables educators to list and publish courses, publish important announcements and save useful website links to additional resources for easy access by learners (WebCT/BlackBoard, 2010; Vula, 2010; KEWL, 2012; Moodle, 2010). An LMS also enables educators to communicate synchronously and asynchronously with students, and for the learners to communicate among themselves. Among other uses, LMS users can upload and view photos, search through a list of terms in the glossary database (Vula, 2010; KEWL, 2012; Moodle, 2010) and access a collection of web pages that can be edited by any person (Moodle, 2010). As opposed to standalone (off-line) technologies that can only be accessed at specific points and geographical locations, a WWW-enabled LMS enhances educational processes in a number of ways. It enables access to educational resources for learners, at any time and from any place (Tick, 2006; Yahya & Yusoff, 2008). Through an LMS, learners can submit assignments, check assessment marks as well as chat with colleagues and educators online (Jungic *et al.*, 2006). The advantage for learners is that the learning experience becomes flexible, convenient and possibly, more efficient (Steel,

[2] e-Learning is defined as a process of learning over an electronic environment. It is frequently seen as process whereby a lecture, with or without students, creates a learning environment on the World Wide Web (WWW) to enable online learning. In many cases, the use of computers, intranets, extranets, satellite TV, video/audio tape, CD ROM, and other electronic platforms, is implied (Welle-Strand & Tjeldvoll, 2002).
[3] The concept of e-Education, according the South African e-Education White Paper (2003: 15)" *revolves around the use of ICT to accelerate the achievement of national education goals*", including the provision of online educational administrative services as well as the teaching and supporting of students online (Rumble, 2001).

2007). For example, learners can simply download relevant learning resources or even search for additional materials at the press of a computer button, 24hours a day and from anywhere (Nunan, 2005). This way, information search and learning become faster and easier whilst time and costs are also saved. Learners are also presented with better opportunities to find information, which adds convenience to their lives (O'Lawrence, 2007).

An LMS is also a useful tool for educators to manage course and teaching activities. They can use an LMS to publish tasks for learners, schedule teaching assignments and manage learner assessments (Merino *et al*., 2006). An LMS also enables educators to list and publish courses and important announcements. Since educators are enabled to communicate synchronously and asynchronously with students, it becomes easier to administer the learning process, for example educators do not have to continuously remind learners about important dates and tasks to be completed (Perrin, 2009). In addition to e-mail facilities for example, educators can also make use of the chat and online conferencing facilities to communicate and teach, particularly in instances where they are unable to physically meet with learners (Kumar & Tammelin, 2008). For administrative purposes educators can keep track of tasks, assignments and manage learner's assessments with the help of the LMS (Avgeriou *et al*., 2003). The advantage for educators is that the process of administering the learning process is more organized, efficient and easier to maintain.

It is clearly shown in this discussion how the new technological innovations and the increased networking of digital computing has improved efficiencies, opened up opportunities and transformed modern life. Using the example of innovations in telecommunications, the innovative developments from fixed line telephony into the first, second, third and fourth generations of mobile phones, added mobility, flexibility and convenience to telephone services. Similarly, the innovative networking of computers and the invention of the WWW has also revolutionized the way we socialize, work, learn, and has improved the living standards of the modern generations, in many ways. Rather than posting a letter and having to wait for several days or weeks for the reply for example, an individual can now send an e-mail or use a chat facility over a social network online to communicate with anyone, anywhere in the world. Through the Internet, individuals and organizations can access and exploit various opportunities, by accessing employment opportunities as well as selling and/or buying products online, so as to improve their life opportunities (Hennyeyova, 2005). With information and knowledge being central to the development and use of the new technological innovations in the information economy of the twenty first century, education becomes central. For example, minimum literacy, skill and the understanding of an innovation determines whether an individual will be able to use and benefit

from the capabilities offered by a new technology, and the WWW is deemed a significant enhancer of teaching and learning processes (Wingard, 2004; Trucano, 2005; Larsen & Vincent-Lancrin, 2005).

The new technologies offer life improving opportunities to the user, yet only those with access, knowledge and the financial means to use them can benefit. Whilst the minority mostly located in developed countries have high levels of education, knowledge and the financial resources to access, use and benefit from the new technologies (Bridges.org, 2005), the majority in underdeveloped countries still live in conditions of extreme poverty (Blackburn, 2008). They lack basic education, skill, knowledge and the financial resources to access, use and benefit from the capabilities of the new ICT.

1.3 Background to the Research Problem

ICT is said to improve educational efficiencies, and is considered a significant means to address educational shortcomings in the developing world (Gutterman *et al*., 2009). The continued inability to access and use this resource condemns the poor to the vicious circle of illiteracy, and continued poverty (Mlitwa 2011). To put an end to this situation, world governments have set Millennium Development Goals (MDGs) to redress social inequality among world populations, by halving the poverty, hunger, disease and illiteracy rates by 2015 (MDG report, 2008). However as it is argued, that "if you give a man a fish you will feed him for one day, teach him how to fish and you will feed him for life" (Chinese proverb), it is important for the poor to be empowered with knowledge at a personal level if redress efforts are to have a lasting impact. Fully understanding this point, the undertaking to achieve universal access to primary education is presented as the second highest priority in the MDGs, with ICT as the major enabler (Minges, 2003). In line with this undertaking, efforts to promote universal access to primary education through the use of ICT have also been established by multinational institutions and in continental structures. At a multi-national level, the Global e-Schools Communities Initiative (GeSCI)[4] emphasizes the deployment of ICT in schools, so as to improve teaching and learning in developing countries (GeSCI, 2009).

A number of these efforts can be seen within continental structures where in Latin America, Asia, and Africa, ICT is applied as a vehicle to advance the quality of, and access to education

[4] The Global e-Schools and Community Initiative (GeSCI) is founded on the consensus within the UN, that education in developing countries need critical development. Funded by Ireland, Sweden, Switzerland and Finland, GeSCI has undertaken to invest in, and deploy ICT to improve teaching and learning in developing countries (GeSC, 2009).

(IDB, 2000). The formation of the Policy Forum[5] on the Integration of ICT into Education by ten Asian countries is an example. Similarly, in South East Asia, the Association of Southeast Asian Nations (ASEAN) have established the SchoolNet project to improve teaching and learning outcomes through teacher training as well as the deployment and integration of computers into school programs (ASEAN, 2010). In Africa, the New Partnership for African Development (NEPAD) also established the e-Schools initiative with the objective to provide computers to every school in the African continent (The Nepad e-Africa Commission, 2010). Through this initiative, NEPAD also undertakes to advance ICT skills to primary and secondary school students and educators, and to coordinate ICT curriculum and content development in all schools in Africa, so as to enhance teaching and learning across the continent (*ibid*).

Within individual countries, South Africa has established the e-Education policy to ensure that every learner is able to use ICT confidently and creatively to develop the skills and knowledge they need to achieve personal goals. As a fundamental aspect of e-Education, ICT is viewed as a resource for teaching and learning, and an enabler of the development of the school as a whole. The main objective is to equip schools with ICT to improve management and administration; to facilitate curriculum incorporation; improve communication and engagement as well as collaboration between teachers and between learners (DoE, 2007).

1.3.1 The South African Context

Due to the legacy of apartheid, the South African education is still facing development discrepancies between the urban and rural schools. Studies by Mlitwa & Nonyane (2008) and Mlitwa (2010) report rural schools to be lacking basic infrastructure such as classrooms, furniture and electricity. The majority of these schools lack libraries, books and other basic facilities needed to support the quality of education. With such a lack of basic infrastructure in these schools, it is unlikely that these schools will be able to acquire computers in the near future, let alone integrate all aspects of ICT in the curriculum as envisaged by the e-Education policy. Unless these developmental discrepancies are addressed, the quality of education will remain compromised in affected communities. By creating the e-Education policy South Africa is therefore taking a positive step to acknowledge and to redress the resource inequalities in its schooling system.

[5] This forum develops policies to ensure a successful integration of ICT in the classroom. The I-Schools Project (to develop open content to enable the equal access to education for learners), and the Smart Schools Program (that promotes access and use of ICT for teachers) are some of the collaborative initiatives of the forum (World Links, 2007).

In collaboration with the Departments of Communications (DoC) (ECT Act, 2002), and of Science and Technology (DST) (National system of innovation, 2002), the South African Department of Education (DoE) developed the e-Education initiative to stimulate the development of technical skills in education (Pandor, 2004). Through its e-Education policy, in 2003 the government undertook to deploy and integrate ICT to curriculum in all schools.

To redress resource inequalities, the e-Education policy sets specific objectives to integrate ICT into all South African schools by the year 2013 (DoE, 2003). The main objectives are to provide ICT resources to support the development and distribution of electronic learning content, so as to ensure that every learner, teacher, manager and administrator has the knowledge, skills and support needed to integrate ICT in teaching and learning. To achieve this goal, the policy sets guidelines to advance teacher ICT competencies by integrating the use of ICT into the teacher pre-service and in-service training. It further pushes for universal access to ICT, through the deployment of networked computers, educational software and online learning resources to all schools in South Africa. The policy further provides for the assigning of a "*dedicated teacher to manage ICT facilities and to champion the use of ICT*" in each school, and the provision of technical training for teachers in every school (DoE, 2003).

ICT facilities and ICT skills are important, but need to be productively integrated into the curriculum if they are to make a positive impact in education (Mlitwa, 2010). A curriculum entails the philosophy, the content, the approach and the assessment of the programme of learning (Harvey, 2004). Integrating ICT into the curriculum therefore, implies the alignment of educational technologies with pedagogy.

With these initiatives the government is taking steps in order to redress the resource inequalities facing the educational system in the country. Given that the e-Education policy was put forward in 2003, it is logical to expect that reasonable progress in the integration and deployment of ICT into the school curriculum, should have taken place by the year 2010.

This study investigates the challenges affecting the successful deployment of ICT into schools and its integration into their curricula, in disadvantaged schools in the Western Cape, South Africa.

1.4 Statement of Research Problem

As a result of the legacy of apartheid, the South African education continues to experience developmental discrepancies between urban and rural schools. Unless these discrepancies are addressed, the quality of education will remain compromised in affected communities (Mlitwa & Nonyane, 2008). As a result, the South African government has undertaken various initiatives to

equip schools with ICT to improve management and administration, to facilitate curriculum incorporation, to improve communication and engagement as well as collaboration between teachers and between learners. In this effort, the e-Education policy propagates the deployment of physical ICT resources into every school, the integration of ICT into the school curriculum, and the empowerment of teachers by equipping them with ICT literacy skills (by integrating ICT skills programs into the teacher-training curriculum).

1.5 Research Problem

A significant problem is that the deployment of computers into schools has not been as successful as the policy had intended it to be (as of June 2010). Whilst notable statistics are evident in urban projects such as 'The Khanya Project' and 'Gauteng Online', these initiatives have not achieved a universal success, as most disadvantaged schools in these regions are yet to be catered for (The Khanya, 2010; Gauteng Online, 2010). The situation is worst in disadvantaged areas where the facilities are needed the most. With the present situation, learners in these schools are not going to benefit from the promise of ICT in education. As a result they will continue to receive a sub-marginal quality of education, which limits their chances of progressing further in their careers, and consequently restricts their ability to improve the quality of their lives.

With respect to ICT training for teachers, these programmes seem to focus on basic administrative computer literacy rather than the understanding of specific educational systems and programs. Hence their relevance in empowering teachers to effectively apply educational technology in their teaching programmes remains uncertain. As a result, it cannot be established for sure whether the program is effective.

Even in a few promising initiatives, acquired computer facilities are not adequately integrated with the curriculum, a situation which calls into question the efficacy of the projects.

1.6 Assumptions

The assumptions in this research are that the successful deployment and integration of ICTs in the curriculum will depend on the:

- Integration and use of ICT in schools or the wish to do so.
- Willingness of both learner and teacher to make use of ICT resources provided.
- That disadvantaged schools would not have made significant progress in implementing ICT into the curriculum.

- Provision of ICT skills training for teachers.
- Availability of qualified and competent persons to provide support for ICT integration and deployment in schools curricula.
- Availability of adequate financial resources to purchase and enhance ICT services and tools.
- Ability of the Department of Education to maintain projects in ICT deployment and integration into school curricula.

1.7 Research Question, Sub-Questions and Objectives

1.7.1 Research Question

How can the discrepancies of the status of ICT deployment and its integration into the curriculum, in disadvantaged schools in the Western Cape, South Africa be addressed?

1.7.2 Sub-questions

1.7.2.1 What is the status of ICT deployment in disadvantaged schools in the Western Cape?

1.7.2.2 How can ICT be deployed into disadvantaged schools?

1.7.2.3 Why should ICT be deployed into disadvantaged schools?

1.7.2.4 Why has ICT not been adequately deployed into disadvantaged schools?

1.7.2.5 How does the disadvantaged situation in schools impact on the adoption of ICT?

1.7.2.6 How do people and institutions for instance, principals, government bodies and teachers, influence the adoption of ICT in to the school curriculum?

1.7.2.7 How does the policy in terms of implementation relate to the current situation in disadvantaged schools?

1.8 Aim of Research

It is understood that policy makers, the public and the private sector are making efforts to redress developmental imbalances between the well developed and the disadvantaged schools. The aim of this study is to understand the status of ICT deployment, and its integration into the curriculum in disadvantaged schools in the Western Cape.

1.9 Research Objectives

The objectives of this investigation therefore, are to gain information about the lack of ICT deployment and integration in disadvantaged schools and insight into the causal factors, so as to inform remedial efforts. In this study 8 participants were interviewed from 4 sampled schools. The information gained from the interviews aided in understanding the status of ICT deployment and integration into schools in disadvantaged communities.

1.10 Contribution of the Research

The research will contribute to the body of knowledge by informing remedial efforts that need to be put in place to solve the problems facing the deployment and integration of ICT into the school curriculum. It will further improve insight and understanding on factors influencing the status of the deployment and integration of ICT into the school curriculum. This will therefore provide policy makers, decision makers and stakeholders with information, or a set of heuristics that can contribute to the efforts made to improve the quality of education.

1.11 Clarification of Concepts

The concepts used in the study are clarified in the following table, Table 1:

Table 1: Clarification of concepts

ICT	In this study, Information Communication Technology (ICT) refers to any product that will store, retrieve, manipulate, transmit or receive information electronically in a digital form. For example, personal computers, digital television, email, robots (Howie, 2005).
Computer-based programs	Specific software to deliver some or all aspects of a course within a curriculum. Examples include a Master Maths, Cami Maths programs.
Deployment	Involves installing, setting up, testing and running of computers
Integration	Implies the alignment of educational technologies with pedagogy and their usage to enhance learning and teaching (Cashman *et al*., 2004)
Curriculum	A Curriculum entails the philosophy, the content, the approach and the assessment of the programme of learning (Harvey, 2004).
ICT literacy	Refers to learners, teachers, managers and administrators having the knowledge, skills and support needed to integrate ICT in teaching and learning (DoE, 2003)
ICT Access	Availability of ICT and computer-based programs specifically for teaching and learning.
Disadvantaged Schools	This term is related to the legacy of apartheid in South Africa, it refers to schools that lack basic resources such as classrooms, desks, ICT facilities, water and electricity, etc (Mlitwa & Nonyane, 2008).
Under resourced communities	Communities that lack equal access to opportunities, credit and financial services, housing, as well as social networks that provide access to information and resources, as compared to other areas (Vidal, 1995).
e-schools	Deployment of ICT and its integration into the school as a whole and into the curriculum (DoE, 2003)

1.12 Limitations of the Study

Due to time and budget constraints the researcher could not study many schools. Therefore only 4 under-resourced schools in Cape Town, Western Cape were the focus of research.

1.13 Summary of Chapter

The chapter discussed the importance of ICT for teaching and learning, the background to and the statement of the research problem, the research question, the aim and objectives, the clarification of concepts as well as the limitations of the study.

1.14 Thesis Structure

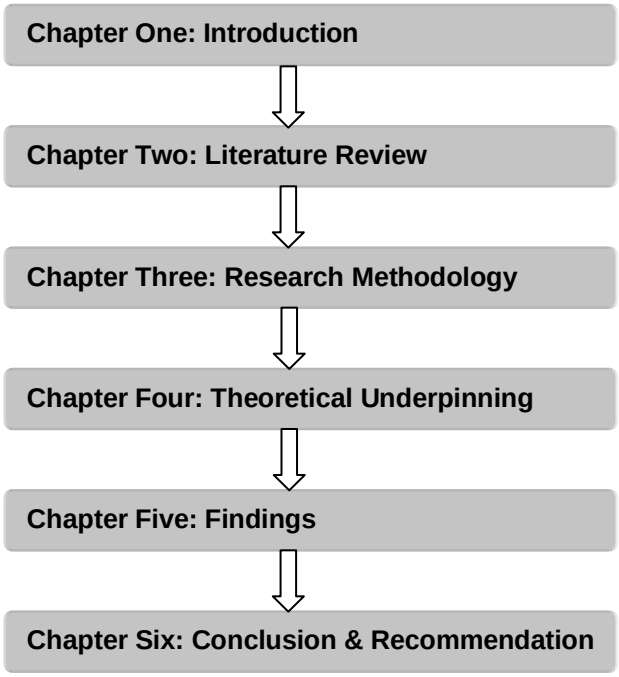


Figure 1: Graphical Representation Diagram of Thesis Layout

Figure 1 provides a diagram of the thesis layout, details of the thesis structure are provided below.

Chapter one contains the introductions, background and research problem. It also includes assumptions, research questions, aim and objectives of the research.

Chapter two provides a literature review on the current status of ICT availability and use in disadvantaged communities as well as the status of ICT deployment in schools and its integration into school curricula.

Chapter three covers the research approaches and methodologies used in Information Systems (IS) research. It further discusses the approach used for this study and why it is appropriate. This leads to an explanation of the research methods, sampling method, data collection method and analysis used as well as the ethical considerations of the study.

Chapter four elaborates on the theories commonly used in IS research and specifies the theoretical approach implemented in the study.

Chapter five presents the findings on the status of ICT deployment in schools and its integration into school curricula. It further provides a discussion of the findings.

Chapter six concludes the study and presents a set of recommendation according to the findings.

1.15 Conclusion

This chapter clarified the area of the study under investigation and provided an overview of the research aim and objectives. The literature that provides a background for the study is presented in Chapter Two overleaf.

CHAPTER 2: LITERATURE REVIEW

2.1. Introduction

Good quality education is an important basis upon which development and economic growth can be built. With this realisation, world governments have created Millennium development goals with universal access to primary education being given a high priority. ICT is seen as an enabler and an enhancer of the teaching and learning process in these efforts. In providing a background for this study, this chapter presents a review of the literature. The chapter opens with a discussion of the significance of ICT (section 2.2). This is followed by practical implementations of ICT globally, across continents and within individual countries (section 2.3). Next is a review of the status of ICT integration into the teacher pre-service and in-service training in the section 2.4.1. Thereafter the current trends in and status of ICT deployment and its integration into school curricula is presented (section 2.4.2). The chapter ends with the section 2.5.

2.2. Significance of ICT

Since 1995 ICT has been a vibrant catalyst for economic growth in most developing countries (Greenberg, 2005). As a result it is seen as an important feature for sustainability and advancement of developing countries (Olakulehin, 2007). In ways similar to its influence in economic development, ICT has enhanced efficiencies in many aspects of modern living. It has improved efficiencies in governance, communication, travelling, buying and selling as well as education (Kramer *et al*., 2007; Hameed, 2007; Wentz *et al.*, 2008). In governance for example, it has enabled convenient and easy accessibility to government services. Now instead of waiting in long queues a citizen can access government services from the comfort of their own home or office (Gichoya, 2005). Similarly, through telecentres ICT has lowered the cost of delivering basic social services and has allowed government offices to be easily accessible (*ibid*). ICT has also ensured good organisation and efficacy of the administrative processes that exist within the government (Asgarkhani, 2005). Travellers are also assisted, since gaining directions to destinations is now facilitated with the aid of applications such as Global Positioning System (GPS), audio guide and pod guide amongst others (Martin, 2005). The buying and selling processes (Hasan & Harris, 2009) have also been made more convenient through e-Commerce (Chang, 2003). With e-Commerce for example, consumers are able to buy goods online and in the comfort of their own homes. As a result time and transportation costs are saved (*ibid*). Furthermore, in what is known as electronic learning (e-Learning) as well as mobile learning (m-Learning), web enabled learning management system can not only facilitate teaching and

learning processes but can also improve efficiencies in educational processes (Kozma, 2008; Mlitwa, 2011). For example, Internet enabled information systems enable access to diverse learning resources (Ndukwe, 2004). Such a system provides fast and immediate access to up-to-date information (*ibid*). It also presents a multimedia approach to education that makes learning easy and fun (Sharudin, 2006). In effect, with ICT such as learning management systems (LMSs), learning can be done at any time, in any place and in collaboration with other learners and or teachers (Cobcroft, 2006).

With the wide range of efficiencies that ICT has to offer, teachers and learners can only fully benefit from these advantages if they are integrated into all the school curricula (Moyle, 2010). For example teachers and learners can benefit from easy access to up-to-date information, any time and any place. They can also benefit from collaborative learning, asynchronous and synchronous communication, educational programs that simplify difficult concepts and facilitate experiments. According to Fredriksson *et al*., (2009), various factors can influence the use of ICT for teaching and learning. These factors include the availability of financial resources, teaching methods, school structures and the availability of ICT infrastructure (*ibid*). For example in European countries such as Denmark, England, Latvia, Poland and Slovenia, due to the availability of financial resources many schools can afford to acquire and to use advanced educational equipments i.e. Smart Boards, for computer aided presentations (*ibid*). Most educators in these countries can make use of PowerPoint to aid the teaching process (Kassim & Ali, 2007). Learners on the other hand, make use of PowerPoint to present group or individual work (*ibid*). Animations can be created through computer programs (e.g. Zimmer Twins and Pixton etc.) or via the Internet and used to explain difficult concepts (Bonifaci *et al*., 2004). Virtual networking laboratory and simulation tools such as Marionnet can be used to facilitate experiments (Fredriksson *et al*., 2009). Teachers and learners can create learning content (e.g. audiovisual material and audio recordings) for individual or collaborative use, with the aid of video and sound editing facilities (Maynard, 2007). Internet enabled ICT further enhances communication between teachers and learners (Blezu, 2008). This is achieved via email or learning platforms (such as Blackboard, Moodle, KEWL and VULA etc.). It also enables information sharing and distribution through integrated media[6] (William, 2003).

Although ICT is beneficial for teaching and learning processes various factors can hinder its successful deployment into schools and its integration into full school curricula. An example is a lack of ICT infrastructure to support ICT deployment (GeSCI, 2009). Consequently factors such

[6] "*A computer-based facility that supports the creation, usage, sharing, distribution and effective communication of information across the boundaries of time and space"* (McLoed et al, nd: 1).

as unreliable IT equipment, vandalism and a lack of technical or financial support can hinder the successful deployment of ICT into schools (Blackmore *et al*., 2003). To ensure full integration of ICT into school curricula one very important requirement is good quality educational software (Amedzo, 2007). This needs to be supplemented with teachers who are equipped and have the confidence to integrate ICT into full school curriculum (*ibid*). Inability to correctly implement ICT into schools can have a negative impact on the quality of education delivered.

The lack of quality education therefore means a lifetime of poverty (*ibid*). To redress the cycle of poverty, world governments have developed the millennium development goals (MDGs) one of which, is to ensure universal access to primary education (UN Millennium Project, 2005; MDG Report, 2008). As an enabler of this goal ICT is seen as a catalyst for knowledge distribution, effective learning and the development of more competent educational services (UNESCO, 2000). The next section 2.3 looks at practical educational ICT initiatives across continents and within individual countries.

2.3. Practical Implementations of ICT into Schools

To promote the use of ICT as a resource and tool for teaching and learning, initiatives have been put into place globally, continentally and within individual countries.

- **Global e-Schools Initiative**

The Global e-Schools and Communities Initiative (GeSCI), was established in 2003 by the United Nations (UN) ICT Task Forces (GeSCI, 2009). The goal of this initiative is to deploy ICT to improve the quality of teaching and learning in primary and secondary education in developing countries (GeSCI, 2012). To achieve this goal the GeSCI engages with Ministries of Education (MoE) and other ministries within a country, to identify the limitations as well as to exploit the potential of ICT (*ibid*). The objective therefore is to help authorities to make informed decisions with regards to the deployment of educational ICT into schools (*ibid*). Outcomes generated from the work of GeSCI are generally educational policies, strategic plans and action plans (*ibid*). Furthermore through the GeSCI ICT facilities are not only deployed into schools but also integrated into school curricula (*ibid*). Along with global initiatives to ensure integration of ICT into schools, there are also practices (ICT deployment and integration into school curricula) within continental structures.

- **ICT in Education: Practices in Latin America**

In Latin America, pressure to integrate ICT into schools has persuaded educational institutions to provide specialized training to aid the effective use of ICT for teaching and learning (Guerra & Jordan, 2010). Since the year 2000 therefore, various Latin American countries have initiated the integration of ICT (such as Internet resources, computers and educational software etc.) into school process by creating ICT policies (*ibid*). Examples of these policies in some Latin American countries are: a Digital Agenda Strategy in Argentina, a National Plan for Digital Inclusion in Bolivia the Green paper on Information Society in Brazil, a Digital Strategy in Chile and a Connectivity Agenda in Colombia (*ibid*). The general aim of these policies is to promote a widespread access to ICT and ICT skills (*ibid*) training. Following on from the policy creation, the implementation strategies were led by inter-governmental structures such as the Latin America and the Caribbean (eLAC) multilateral organisation with the aim of fostering economic development and social inclusion in the region (*ibid*).

Within the individual Latin American countries, approaches to the subject of ICT implementation vary according to how the concept of ICT integration into school education is viewed. In Argentina for example, education is seen as a way of developing human capital and is considered a significant enabler (Auguste *et al*., 2008). To ensure quality education therefore, the central focus of developmental strategies is to ensure integration of ICT into schools to improve or maintain the quality of education (*ibid*). This is achieved by specialist training in technologies (such as learning programs) as well as promoting innovation, research and development within the country (*ibid*). In Uruguay for example, the 'CEIBAL' (i.e. Basic Computer Educational Connectivity for Online Learning) was developed to promote ICT deployment into schools and its integration into schools curricula (Gutterman *et al*., 2009). The focus of CEIBAL is on educational infrastructure, curriculum redesign and digital inclusion (Winocur & Aguerre, 2011). As part of the One Laptop per Child program, CEIBAL also seeks to provide personal laptops for all teachers and learners within public schools in Uruguay (Prusa & Plotts, 2011). Finally, in Chile strategies to promote ICT in education are focused on developing course content, ensuring good infrastructure and building teacher as well as learner ICT skills (Light, 2010). Clearly, the fact that organizations within individual countries in Latin America are making efforts to deploy ICT into schools and to integrate it into school curricula indicates the significance they attach to it. Furthermore, this indicates the importance of ICT in the field of education in these countries as it is supported at high organizational levels.

- **ICT in Education: Practices in ASIA and the Pacific Region**

Despite efforts to improve the quality of education, the status of equal access to quality education in Asia and the Pacific region is mixed. In the area as a whole, the status of access to education, has improved over the years (The Global Monitoring Report, 2008). The literacy rate for East Asia and the Pacific for example, has risen from 95% to 98% for both females and males (UNESCO, 2010). In South and West Asia on the other hand, the literacy rate has risen from 61% to 80% (*ibid*). Although this is a great improvement, sadly in this region emphasis seems to be placed more on access to education rather than the quality of educational content delivered (The Global Monitoring Report, 2008). As a result a large number of children complete schooling without acquiring adequate literacy and numeracy skills to help them further their education, or to become employable and by this means improve their standard of living. Although noteworthy progress has been made in terms of the literacy rate over the past years, illiteracy, specifically for females, is still a problem, mainly in the South Asian countries (The Global Monitoring Report, 2008). These South Asian countries still have a large number of children, particularly girls who still lack access to quality education (UNDG, 2010). In essence 66 percent of out of school children are girls (*ibid*). It is for this reason that both regional development organisations and national governments in this region are turning to ICT to provide solutions to problems in their schooling systems.

In Asia initiatives to promote ICT in school education have also taken place across the continent and within individual countries. Across the continent for example, the Asian Development Bank (ADB) is supporting efforts towards the achievement of the Millennium Development Goals (MDGs), to reduce the poverty and illiteracy rate by half by year 2015 (ADB, 2003). In this regard, the ADB has developed a policy (i.e. ADB's Policy on education) to help create an ICT enabling environment, to develop ICT applications and information content and to provide ICT skills training (Loxley, 2004; Assessment, 2008). The policy advocates equal access to quality education for all children and adults in Asia and the Pacific regions (*ibid*). The aim is to empower these people to improve their standard of living, to break the cycle of poverty and to enable them to be involved with national developmental strategies (Islands, 2004). ICT is further seen as a resource and tool to improve the quality of education and make it accessible to all, hence the ADB has developed an ICT in education policy (i.e. ADB's Policy on education) to ensure its integration into school curricula (ADB, 2009).

In addition to the ADB's ICT policy development, individual countries within Asia and the Pacific Region have created ICT in Education Master Plans (Lallana, 2012). Examples of these countries are Cambodia, China, India, Japan, Korea, Malaysia, Mongolia, Singapore, Sri Lanka,

Thailand, Vietnam, Australia and New Zealand (*ibid*). To aid in the creation of these master plans a toolkit (i.e. ICT-in-Education Toolkit) can be accessed online for policy makers, practitioners and planners (OECD, 2009). The ICT-in-Education Toolkit contains toolboxes that provide interactive tools and step by step guidelines that assist users in the policy development process (ICT-in-Education Toolkit, 2007). On a practical level however the status of ICT deployment and its integration into curricula varies from country to country. In many schools in Brunei, Malaysia, Singapore and Vietnam for example, ICT is seen as a significant tool and an enabler of the teaching and learning process and it is integrated into all subject areas (Park, 2011). In Indonesia, Myanmar, the Philippines and Thailand on the other hand ICT is only integrated into a few subjects, with the highest priority being given to Information Technology (IT) courses (OECD, 2009). In Timor-Leste and Lao PDR only the schools that opted to experiment on ICT usage have basic application training for both teachers and learners (*ibid*). Nevertheless, the presence of a practical focus on ICT in schools, however small it may be, shows the belief that countries have in the promised benefits of ICT.

- **ICT in Education: Practices in Africa**

In Africa a need for social transformation and economic development is used as the basis and justification for investments in educational reforms (Ang'ondi, 2010). ICT is therefore seen as a tool and an enabler of equal access to quality education (Wahab, 2006). As a result there has been a progressive shift in the process of adoption and distribution of ICT in education in Africa (Farrell & Isaacs, 2008). Within the phase of ensuring system implementations, priorities have been given to creating governmental policies that inform implementation efforts (*ibid*). Consequently most countries across the continent have taken steps to create ICT policies to articulate the ICT goals and implementation strategies for the educational sectors of government. Thus in those countries with ICT policies that indicate national commitment to ICT development it can be assumed that the educational sector can expect advancements in educational technology implementations in the schooling sector as well. The converse can also be assumed, in that countries with no policy undertakings may be least likely to have basic infrastructure that could support implementations of educational technology in schools.

With regards to policy creation in Africa therefore, Table 2 presents the progress of general ICT policy between 2000 and 2011, and the number of countries in Africa where this is taking place. Policies of ICT for teaching and learning in schools are outlined in Table 3 and discussed in sections that follow.

Table 2: Development of General National ICT Policies

The status of ICT policy development	**2000***	**2005***	**2007****	**2011*****
No of countries with policy in place	13	28	36	43
No of countries with policy under development	10	15	12	10
No of countries with no policy developments in process	30	10	5	0
Total No of countries	53	53	53	53

* Source: UNECA (2008)
** Source: Farrell & Isaacs (2008)
*** Source: UN (2012)

According to Table 2, the status of ICT policy development in Africa ranges from countries with no ICT policies in place via those in the process of developing a policy, to those with developed policies in place. Table 2 also shows the progress of ICT policy development over a period of eleven years. For example in 2000 very few countries had an ICT policy and the number of countries without a policy in place was more than double the number of countries that had developed a policy. The idea of ICT being a resource and tool for teaching and learning has been embraced gradually over the years 2000 to 2011. This is evident as the current status of ICT policy creation across the continent has improved significantly, with over 86% of African countries having an ICT policy in place in 2011 (Chekol, 2011). With this, educational sector policies are often embedded into national ICT policies. The creation of policy indicates that national governments are taking positive steps to promote the use of ICT for socio-economic development.

From a general ICT policy perspective, most countries across the continent are in the process of transforming their telecommunication policies to promote more competition within the industry (Touré, 2007). A general ICT policy in the case of South Africa for example, refers to e-Education policy by the national Department of Communications (DoC) that provides a guideline to the South African Government's response to a new information and communication technology environment in education and regulates conditions for ICT in education to thrive

(DoE, 2003). Anticipated implications for ICT access in schools is, hopefully, a declining cost of access to quality infrastructure. Though the cost of access to information and telecommunication is decreasing, most educational institutions are unable to gain Internet connectivity due to limited financial resources (Tino, 2003). There is also a huge gap in terms of infrastructure development between the urban and rural areas (Farrell & Isaacs, 2008). For example, poor access to reliable electricity supply is a general problem in most countries across the continent (Eberhard *et al*., 2008). However, the situation is far worse in rural areas due to the challenges of connecting to national electrical grids (Haines, 2006). A greater problem is a lack of resources to provide ICT training and technical support (Bingimlas, 2009). Consequently there is a gap between the availability of ICT resources and competent individuals to integrate them into school curricula (Adebisi, 2008). Although national governments across Africa are taking relevant steps to promote ICT in education, the continent is plagued with poor infrastructure and resource inequalities (Farrell *et al*., 2007).

With the socio-economic issues that exist on the continent, there is a definite variation in the level to which countries are able to carry out their proposed educational technology strategies (*ibid*). For example, a need for appropriate infrastructure and a more mature economy means that few countries on the continent, such as South Africa among others, are able to implement their national ICT strategies (*ibid*). On the other hand due to their resources and high bandwidth connectivity gained from Europe, a few countries in the Northern parts of Africa have made significant progress in their ICT development strategies (Farrell & Isaacs, 2008). Furthermore countries that are moving towards a more stable economy such as Botswana, Mauritius, Ghana and Cameroon identified the provision of ICT applications to their local economies as a high priority (Economic Commission for Africa) (*ibid*). Sadly however, a large number of countries on the continent are either in conflict or emerging from a period of conflict and dictatorial leadership (Chacha, 2004). Although these countries see ICT as a tool to aid their efforts to promote equity and quality in education, internal conflicts and political instability make progress on ICT for education initiatives difficult. Fortunately even without policy development or adoption, there have been initiatives led by the formal school sectors to promote the integration of ICT into schools in most countries (Farrell & Isaacs, 2008).

- **ICT Initiatives in Primary and Secondary Schools in Africa**

Across the continent, countries such as South Africa, Senegal, Mali, Ghana, Nigeria, Cameroon, Namibia, Uganda and Kenya (to name but a few), have had ICT in education initiatives that were driven mainly by educational institutions (such as primary and secondary schools) (Farrell *et al*., 2007). Within these countries the use of ICT in schools has been made possible by large organizational programs such as the World Bank's Links for Development and SchoolNet Africa. It is clear then that ICT is seen as a tool for achieving educational outcomes (LaRocque & Latham, 2003). With the advances that ICT has to offer for the teaching and learning process, it is vital that every learner has access to ICT resources, in order to experience its full benefits. To this effect, most African countries (e.g. Ghana, Botswana, South Africa, Zambia, Kenya and Namibia) that have developed national ICT in education policies, place great emphasis on universal access and use of ICT in all schools. Furthermore, formal structures on the continent, such as New Partnership for Africa's Development (NEPAD) have developed programs such as e-Schools Initiative to promote universal access and use of ICT in all schools (NEPAD, 2010).

- **NEPAD e-School Initiative**

The NEPAD e-Schools initiative was launched in 2003 (*ibid*). The initiative views the acquisition of ICT skills by learners as crucial in ensuring that they are able to partake in the global information society and knowledge economy (Farrell *et al*., 2007). To this effect, the initiative advocates for the universal access to and use of ICT (Ayere *et al*., 2010). To ensure universal ICT access and use, the project seeks to deploy ICT equipment (i.e. computer, radio, television, phone, scanner, cameras, copiers, etc.) into all primary and secondary schools and connect them to the Internet (*ibid*). The overall goals of the e-Schools initiative is to equip all Africans in primary and secondary schools with ICT skills, and to train teachers with skills to use ICT tools to improve the teaching as well as learning processes (DoE, 2003). Finally the initiative seeks to equip school managers with ICT skills to coordinate management and administration in schools (Onguko & Hennessy, 2010).

With regards to the NEPAD e-Schools' initiative goal of physical deployment, the estimates in Table 3 below indicates that the status of physical deployment ranges from countries with computers in many schools to countries with computers in very few schools.

Table 3: Status of ICT Deployment into Schools in Selected African Countries 2006

Country	Number of Schools	Schools with computers	Percentage schools with computers
Ghana	32000	800	2.5%
Namibia	1519	350	22.1%
Egypt	39 926	27 838	69.7%*
Mozambique	7000	80	1.1%
South Africa	25582	6651	22.6%

* Source: Farrell *et al* (2007)
Source: Farrell and Isaacs (2008)

According to Table 3, out of the 5 sampled countries Egypt has the highest number of schools with ICT facilities (i.e. computer labs with Internet connection). Considering that the aim of the NEPAD e-Schools initiative in 2003 was to ensure universal access to ICT, the progress that has been made is not as significant as would have been expected. It is clear from Table 3, that negative factors within individual countries such as Ghana and Mozambique are stronger that the continental e-Schools goals.

Similarly in South Africa efforts have been made to ensure universal access to ICT. Due to the legacy of apartheid South Africa is facing developmental discrepancies because of the continued existence of poverty and underdevelopment. As a result the privileged few mostly in urban areas have many more opportunities than the underprivileged majority, mostly in rural areas. Whilst learners in affluent urban areas are able to benefit from a good quality education, learners in disadvantaged communities continue to lack the resources and access to such facilities. The continued gap between the rich and poor means that learners in these under-resourced schools will miss out on establishing a good foundation to their education. This is very likely to hinder them from doing well at tertiary level. It could also prevent them from gaining the right skills to make them employable and to improve their standard of living. As a result remedial efforts are crucial to redress these resource inequalities and the South African government is taking positive steps towards this end. By creating the e-Education policy the South African government recognizes the importance of ICT for teaching and learning. The goal of this policy is to ensure that every learner is able to use ICT confidently and creatively to develop the skills and knowledge they need to achieve personal goals (DoE, 2003). Below is a review of the current status of ICT deployment into schools and its integration into school curricula

2.4. ICT Integration initiatives in Disadvantaged Schools in South Africa

2.4.1. ICT Integration into the Teacher Pre-Service and In-Service Training

Considering the integration of ICT into the teacher pre-service[7] and in-service[8] training, the teacher-training institutions have incorporated the ICT literacy component into educators' training programmes. Institutes such as the Cape Peninsula University of Technology (CPUT), the Durban University of Technology (DUT), Nelson Mandela Metropolitan University (NMMU) and others have integrated email, end-user computing programming, Internet, as well as word processing and spreadsheet skills into their pre-service as well as in-service training (CPUT, 2010; DUT, 2010; NMMU, 2010). DUT further provides keyboard skills training, typing-speed development, computer application technologies and database skills development for its teacher trainees (DUT, 2010).

Whilst this initiative is commendable in introducing teacher trainees to computer literacy, these programmes seem to focus on basic administrative computer literacy rather than the understanding of specific educational systems and programs. Hence the relevance of this basic computer literacy training in empowering teachers to effectively integrate educational technology into their teaching programmes remains uncertain. As a result, it cannot be established for sure whether the program is effective. Due to this uncertainty, and the current limited levels of ICT literacy among the existing generation of teachers in disadvantaged schools, the government, non-governmental organizations (NGO) and the private sector are collaborating to offer additional initiatives to enhance ICT literacy among South African teachers. To this effect, the public-private collaborative initiatives include the South African-Finnish Co-operation Programme in the Education Sector (SCOPE)[9], School Net SA[10] projects, among others.

These programmes have created 11 teacher development modules to introduce ICT into schools, with about 25 000 teachers trained thus far (DoE, 2003). The Computing Technology

[7] Pre-service Training is the standard level of training provided to teachers though institutional training and education (DUT: Faculty of Arts & Design, School of Education, 2010)

[8] In-Service Training is a work orientation program that equips upcoming teachers to instruct learners (D0E, 2003).

[9] The SCOPE program is a project that seeks to contribute to the capacity and to enhance the quality of educators in SouthAfrica (Thutong, 2010). An important development area of SCOPE is for teacher training. Other aims of the program include ICT in teaching as well as special education (global.finland, 2010).

[10] "SchoolNet SA provides online, mentor-based in-service training to teachers to introduce ICT into the school curriculum and management" (DoE, 2003:11).

Industry Association (CompTia); Microsoft; and the INTEL "Teach to the Future"[11] all offer ICT training initiatives to promote the integration of ICT into teaching practices (Roberts *et al*., 2009). Together with Telkom, Thintana also committed over R200m to support education and training in the areas of ICT in 2003 (DoE, 2003).

Despite these collaborative efforts however, scientific evidence by George (2007); Zuzile (2007); Mlitwa & Nonyane (2008); suggest that many rural and remote schools lack basic facilities and skilled teachers. On this basis, it is clear that existing initiatives are not adequately addressing ICT literacy limitations in those disadvantaged areas where they are needed most.

2.4.2. Trends in ICT Deployment and its Integration into Schools

On the physical deployment of networked computers to all schools, the rate of progress is mixed, with extreme differences between under-resourced and developed communities.

At the positive extreme, the collaboration between the government, the private-sector and the public-private collaborative projects, is on a large scale and growing in urban areas, whereas the rural areas are left out.

Provincially progress with the integration of ICT into schools has been made through the development of various projects. Some of these projects include:

'The Khanya Project', which is an initiative to deploy computers and integrate them into the curriculum in all the schools in the Western Cape, and is a useful example of the government's initiative in the province (The Khanya Project, 2010). In fulfilment of its goal, 1102 (ibid) out of 1569 (EMIS, 2008) schools have been equipped with computer facilities. A similar initiative, the 'Gauteng Online', with a mission to deploy ICT into all the schools in the Gauteng province is reported to have installed computers into 1000 (out of 2390) schools (*ibid*) in the province by the end of 2009 (Gauteng Online, 2010). Nationally, the 'Teacher Laptop Initiative' (TLI) was also launched in 2009, to provide cost effective and networked laptops to all school teachers (ELRC, 2010).

'The Khanya Project' has made reasonable attempts to integrate ICT into some, though not all aspects of the curriculum. On this point, the software placed in schools namely Master Maths and Cami, etc, are relevant only to specific subjects such as science and maths (The Khanya Project, 2010), which leaves the other subjects without ICT integration.

[11] "Teacher Development Program provides teacher training in ICT integration into teaching and learning" (DoE, 2003:11).

The ‘Gauteng Online Project’ on the other hand, has only had limited success since its inception in 2001. Having aimed at installing networked computers into all the schools in the province by 2006, the project had installed computers in 1000 schools (out of 2390 schools) by the end of 2009 (The Star, 2009). The national rate of success is even bleaker. When it comes to the availability of computers in schools, first there needs to be appropriate infrastructure in place such as electricity and telephones. This situation will at least create the potential for implementation or for access to telecommunications. However 15% of ordinary (public and independent) schools in South Africa do not have electricity and 55% do not have a telephone connection (DoE, 2009). Most of these schools that do not have appropriate infrastructure are in the rural parts of South Africa. At present only about 23% of schools (public and independent) in South Africa have community centres for ICT (DoE, 2009) and only about 15% schools have laboratories available (DoE, 2009).

It is clear that to date the deployment of computers into schools has not been as successfully implemented as the policy had intended (as of June 2010). Whilst notable statistics are evident in urban projects such as ‘The Khanya Project’ and ‘Gauteng Online’, these initiatives have not achieved the universal success that was intended. The situation is worse in disadvantaged areas where the facilities are needed the most. The problem is that whilst a need to ensure that all learners have access to the same quality of education is recognised, the failure to implement noble policies means that learners in disadvantaged schools continue to lack even the most basic facilities. With the status quo, learners in these schools are not going to benefit from the promise of ICT in education. As a result they will continue to miss out on educational solutions offered by ICT, which limits their chances of progressing further in their careers, and ultimately to improve the quality of their lives.

2.5. Conclusion

In this chapter a background for the study was presented. This background included a brief discussion of the importance of ICT in economic development, modern living and for the teaching and learning process. It further discussed how ICT is used for teaching and learning processes and factors that hinder its successful integration into schools. This was followed by a presentation of practices of ICT deployment into schools and the integration of ICT into school curricula globally, on a continental scale and within individual countries. Lastly the review of ICT deployment and its integration into school curricula in South Africa was presented. The next chapter (Chapter 3) presents the type of research conducted, the paradigm and the methods used to carry out this investigation.

CHAPTER 3: RESEARCH APPROACH AND METHODOLOGY

3.1. Introduction

This chapter outlines the research design as well as methodologies commonly used in Information Systems (IS) research. It further discusses the research design, methods and techniques adopted for this study. The chapter begins with a brief overview of the Information Systems (IS) discipline in the section 3.2. The research paradigms are outlined in the section 3.3. This is followed by a discussion of the ontological and epistemological stances from which the study is viewed in the sections 3.3.1.3 and 3.3.2.3 respectively. At this point, an outline of the methodologies used in the interpretive research paradigm is provided followed by the research methodology adopted for this study and the data sources in the sections 3.4, 3.4.3 and 3.4.4 respectively. The sampling methods are then presented in the section 3.5. This is followed by the sampling process used for the current study and the criteria for selection of participation samples in the sections 3.6 and 3.6.1 respectively. The data analysis methods and ethical considerations for the study are provided in the sections 3.7 and 3.8 respectively. Finally the chapter summary and conclusion are presented in the sections 3.9 and 3.10 respectively.

3.2. Information Systems

The research conducted falls under the Information Systems (IS) field of study. IS draws from Computer Science which is a young engineering discipline. With its origins in computer science; the origins of IS provide it with a multidisciplinary focus (Peffers & Ya, 2003). This is because it draws from other disciplines namely management studies and social sciences (i.e. sociology and psychology). Due to it being interdisciplinary it has shifted from a purely techno-centric focus, to include a social focus dominated by socio-technical design approaches (Baskerville & Myers, 2002).

IS research is both an academic discipline (Benbasat & Zmud, 1999) and an applied field (Baskerville & Myers, 2002). As an academic discipline, it focuses on teaching and equipping individuals with the adequate skills needed in the work force (Benbasat & Zmud, 1999). In this way, people learn, produce research and acquire relevant skills. The academic aspect of IS therefore connects the business and computer science fields (Wade *et al*., 2006). As an applied field; products are built for public consumption. Examples of these products are systems such as databases, applications, software and websites. For products to be built and to be used correctly, skills must be there. The academic discipline supplies skills and knowledge to the field of practice.

3.3. Research Paradigms

In order to indicate the type of research conducted, it is important to first identify the research paradigm under which the study falls. A research paradigm defines for the researcher what it is they are about and what falls within and outside the limits of their research (Guba & Lincoln, 1994). The research paradigm is a theory or hypothesis, or a framework, in which the research theories that influence ones perspective and views of the world are built (Henning *et al*., 2004). It therefore helps to shape the understanding of the interconnectivity of real life elements. Fundamental questions such as the; ontology, epistemology and methodology help define a particular research paradigm. With the ontological question the researcher studies the nature of being. Next with the epistemological question the researcher is concerned with the policies that help identify what is known about the world (*ibid*). Finally the methodological paradigm deals with the principals used to obtain valid knowledge (*ibid*).

To guide the research process there are philosophical assumptions that can be adopted by the investigator. These range from ontological realism, social constructivism to relativism as well as the positivist, critical, interpretivist theoretical epistemologies.

3.3.1. Ontology

Ontology is a philosophical discipline. Its origins are found in a branch of philosophy namely metaphysics (Romay & Cuesta, 2006). The focus of metaphysics is on the nature of reality (i.e. existence). Hence it analyses the types of existence, focusing mainly on the nature of reality (Ritchie, 1894). In other words what is known about the world, and how things that exist are categorised and understood (O'Leary, 2007). It is a study or science of being that seeks to describe the basic categories and relationships of being or existence (Gruber, 1993). To clarify the ontology phenomenon, realism, social constructivism and relativism categories are discussed briefly in the following passages.

3.3.1.1. Realism

Realism is an ontological viewpoint which sees reality as separate from the mind (Tyler, 2006). As a philosophical theory it promotes the existence of an authentic, physical world that is external to individuals (Uddin & Hamiduzzaman, 2009). Additionally it assumes that things exist separately from our experiences and that these things influence or give explanations to our experiences (*ibid*). The underlining assumption in realism is that there is an objective reality. Hence, the physical world is a separate reality from insight and mind (Van der Walt, 2008). Furthermore in realism, truth or knowledge is said to be associated with structures of the mind and things that exist in the world (Prawat, 1995; Schuh & Barab, 2008). As a result of the

objective principle realists believe that classifications of things given in nature should not be subjective (*ibid*).

The current study seeks to understand the status of ICT deployment into schools and its integration into school curricula. To achieve this, participants from sampled schools will be interviewed to gain an in-depth understanding of their experience with regard to the deployment of ICT and its integration into school curricula. The findings will therefore be subjective to the sampled schools as well as the research participant and not independent of these participants therefore the study cannot be viewed from realist ontological stance.

3.3.1.2. Social Constructivism

Social constructivism is a social theory that deals with the construction of reality (Jackson & Sorensen, 2006). It focuses on human awareness or perception and its position in world affairs (Chandler, 2011). In other words, the opinion, ideas, perception, languages and understanding amongst human beings (*ibid*). It therefore emphasizes the significance of cultural perspectives and context in understanding social occurrences and on constructing knowledge based on this understanding (Kim, 2001). Social constructivists believe that reality is constructed through human activity (Sohel, 2010). In other words the social world of individuals along with everything that is involved is created by those individuals (*ibid*). For the social constructivist, reality is not something that can be discovered, it therefore does not exist until it has been invented in society (Kim, 2001).

The study seeks to identify and understand what factors affect the successful deployment of ICT into schools and its integration into school curricula. It does not deal with constructions of reality or of human awareness or consciousness and how it is related to world affairs therefore it does not make use of the social constructivist ontological stance.

3.3.1.3. Relativism

Relativism is a general principle (Schuh & Barab, 2008). From a relativist perspective the way in which reality about ways of living or beliefs is viewed is relative to a specific point of view (Johnston, 1993). This point of view can therefore vary from individuals or groups of people (*ibid*). Reality from this viewpoint is therefore dependant on social circumstances and experiences (Caruana, 2006). It is also restricted and specific to the observer and the situation or context at hand (*ibid*). There is therefore no absolute truth in the world (Wright, 2008). Rather, there are individual constructions that rely highly on the actual individuals building those constructions (*ibid*).

The current study seeks to gain an in-depth understanding of the factors affecting the successful deployment of ICT into schools and its integration into school curricula, therefore it falls under the relativist ontological stance.

Ontology can be said to study conceptions of reality to the extent that its counterpart epistemology can be represented as being a search for answers to the questions of "what is known?" and "how it is to know?". A discussion of epistemologies (i.e. the positivist, critical and interpretivist theoretical epistemologies) and finally, a section on an epistemology relevant to this thesis, are outlined in the sections that follow.

3.3.2. Epistemology

3.3.2.1. The Positivist Research Paradigm

The Positivism research paradigm aims to create statements that are true, by describing the world in an objective way (Thomas, 2010). IS research is positivist if there is an indication that there are variables that can be measured quantifiably, hypothesis testing and conclusions drawn about a phenomenon from a representative sample of a given population (Orlikowski & Baroudi, 1991). In positivism, reality is generally observed and explained from an objective perspective (*ibid*). Furthermore reality is controlled by creating variations in a single independent variable (Persson, 2010). This allows regularities to be identified and relationships to be formed between elements of the social world (*ibid*). The research methods associated with the positivist research paradigm include empirical, measurement, experimental and structured observations (Cecez-Kecmanovic, 2012). Types of studies conducted within the positivism research paradigm are namely survey studies, verification of a hypothesis, statistical analysis, quantitative and descriptive studies (*ibid*).

Since this study intends to provide an in-depth understanding of ICT deployment and its integration into the curriculum in disadvantaged schools, rather than quantifiable measurements or hypothesis testing, a positivist research paradigm is not appropriate. At this point the critical and interpretive research paradigms are explored.

3.3.2.2. The Critical Research Paradigm

Critical research can be applied to both the positivism and interpretivism research paradigms as an additional level of analysis (Niehaves & Stahl, 2006). It seeks to enhance opportunities for realizing human potential by questioning the social norms (Myers & Klein, 2011). This is done to a point whereby the restrictive and alienating conditions of the norms in everyday living are elaborated (Alvesson & Willmott, 1992). Critical research seeks to highlight the problems that

exist in society and to further eliminate these issues (Howcroft & Trauth, 2008). In IS, critical research mainly focuses on; liberty, social control values in relation to the development, use and impact of information systems technology (*ibid*). Furthermore an investigator's values influence the research process (Harrisson & MacGibbon, 2001). This means that facts are not separate from values (*ibid*). With this a dialogical method is used to encourage dialogue between the researcher and the study being conductor (*ibid*). Critical research focuses mostly on questioning existing practices with the goal of fostering emancipation (Howcroft & Trauth, 2008). For example where there are racial, economical, or gender inequalities, it poses questions about these social injustices and seeks to foster change. An example of gender inequality is when a male and female with equal skills apply for the same job vacancy and upon employment the female employee receives a lower salary than her male counter part. Critical research therefore fosters the critique aspect when things are not what they should be.

Thus a critical research paradigm is used to look at and question the status quo which are inequalities in access to and use of ICT for teaching and learning in schools in disadvantaged communities.

3.3.2.3. The Interpretive Research Paradigm

Interpretive as an IS research paradigm assumes that knowledge of reality is only obtained through social constructions (Walsham, 1995). For example, language, perceptions, shared meaning, documents, tools and other artefacts (*ibid*). Interpretivism involves engaging in understanding on both an organizational and individual level. It views knowledge as based on observable events, personal beliefs, values, reasons and understanding (Ojong & Muthuki, 2010). It presupposes that as people experience and interact with their immediate world, they create and relate their own subjective meaning (Orlikowski & Baroudi, 1991). Among interpretivists, knowledge is based on meaning making of the lives of individuals (*ibid*). Researchers within the interpretivist research paradigm therefore, seek to understand phenomena by examining the meanings that participants assign to them (Ojong & Muthuki, 2010). The types of studies conducted within the interpretivism paradigm include field research and case studies which mainly focus on understanding of phenomena. The aim of this study is to understand the status of ICT deployment, and its integration into the curriculum in disadvantaged schools. The objective of the investigation therefore, is to gain insight into the status quo and its causal factors, so as to inform remedial efforts.

This research therefore falls under the interpretive paradigm for the reasons that it seeks to gain an understanding of the situation, not only at an organizational level (schools and department of education) but also at an individual level (teachers and learners). In this study the interpretivist

paradigm borrows from the critical research paradigm in order to criticize the status quo (inequalities in access to ICT for teaching and learning). Thereafter the interpretivist paradigm will aid the investigation process by providing a platform that will help in understanding the factors affecting ICT physical deployment and its integration into school curricula, together with the causal factors, in order to inform policy. The research methodologies commonly used with the interpretive research paradigm and the research design for the study are further discussed below.

3.4. Research Methodology

A research methodology deals with how a researcher can discover what they believe is known (Guba & Lincoln, 1994). This involves the principals used to obtain valid knowledge (O'Leary, 2007). For example, the techniques and methods or procedures used in the research process (Babbie & Mouton, 2001). Methodologies commonly used in the interpretivist research paradigm include; participatory action research, quantitative and qualitative research approaches. In research the type of methodology used depends on the research problem, research question, type and source of data to be collected and the analysis processes required. The current study makes use of the qualitative research approach.

3.4.1. Participatory Action

Participatory action is a research paradigm that involves the active participation of some of the members who are the subjects of study (Babbie & Mouton, 2001). In this instance these members participate actively in all phases of the research process from the project design through to its implementation. Included in the phases of the research process are the actions that come with or follow after the research is completed (*ibid*). Since the participants within this research will only help in gaining relevant information that will contribute to efforts to solve problems with ICT deployment and integration into schools curricula, participatory action research paradigm is not appropriate.

3.4.2. Quantitative Research

Quantitative as a research paradigm, makes use of numerical data from a selected sub-group of a population in order to generalize findings to the universe been studied (Maree, 2007). It is a research process that is systematic and objective in its ways. It refers to measurements in numeric forms rather than to characteristics that are descriptive (O'Leary, 2007).

Since this study aims to gain an in-depth understanding of ICT deployment and its integration into the curriculum in disadvantaged schools, it will provide descriptive characteristics rather than numerical data. Therefore this research method is not appropriate.

3.4.3. Qualitative Research

Qualitative research studies people or systems by interacting with and observing the participants in their natural environment and focusing mainly on their meanings and interpretations of what is being observed (Halloway & Wheeler, 1996). It refers to characteristics that are descriptive and not to numeric measurements (O'Leary, 2007). In addition, it is concerned with understanding the research phenomenon from its social and cultural contexts that form the basis of various behavioural patterns.

Since the current study seeks descriptive insights from the socio-technical contexts, the qualitative research paradigm seems appropriate, and therefore its methods and techniques are used in this investigation.

Within qualitative research, various qualitative research methods exist. A research method is a strategy of the inquiry process of an investigation (Myers, 1997). It moves from a hypothesis to research design and data collection. The research design and data collection process are influenced by the choice of research methods (*ibid*). The various research methods that fall under the qualitative research paradigms include ethnography, grounded theory and case study amongst others. The case study method is used in this research.

3.4.3.1. Ethnography

Ethnography is a method that requires the researcher to be involved in the lives of the research participants, so as to experience and gain their view of the world (Emerson, 1995). This enables a researcher to describe the cultural norms that apply to the research participants and how they work (*ibid*). Ethnography is concerned with the development of theoretical ideas rather than testing an existing hypothesis (Goldbart & Hustler, 2005). The design implication of ethnography is that the ethnography researcher needs to be open to research problem formulation (*ibid*). Generally in ethnographic research, what is practically possible can often shape ethnographic work. The shaping of the work begins to sample the particular setting that involves particular participants within particular times.

This research does not seek to experience and gain a world view of research participants. Rather it seeks to gain relevant information from participants to help contribute to efforts to solve problems in ICT deployment and integration into school curricula. Therefore ethnography is not an appropriate research method.

3.4.3.2. Grounded Theory

This is a theory generating research methodology (Strauss & Corbin, 1997). It is a research process that provides an understanding about how people, organizations or communities experience and respond to events that occur (Rodon & Pastor, 2007). This is achieved through integrated theory building (Glaser & Strauss, 1967). The theory is based on actual data gathered through qualitative research (*ibid*).

Since this research does not seek to generate theories, but rather to understand ICT deployment and its integration into the curriculum in disadvantaged schools the grounded theory method is not appropriate.

3.4.3.3. Case Study

A case study method is an in-depth analysis of individuals or events, which represent or explain the phenomenon of interest (Bromley, 1991; Jackson, 2008). With a case study method, the researcher determines in advance the information to be gathered and the data analysis techniques to be used to answer the main research question (*ibid*). Case study methods can be used to produce studies of new policies, for example the strategies used to ensure the universal access to ICT in all schools in South Africa. The aim of case study research is to understand the factors that affect a specific situation (Maree, 2007). The sources from which data is collected are further discussed below.

In a case study research data gathering techniques include; reading and analysing documents, participant-observation, direct observation, the analysis of physical artefacts, and the conducting of interviews (Yin, 1994). The reading and analysing of documents is often used to gather information on background and methodologies. In cases where researchers require direct experience within a specific situation, participatory observation is often applied. Similarly, in cases where a researcher's own understanding and interpretation are required, a researcher would make a direct observation of a situation, without taking an active part. Finally, in order to gain insight from the knowledge that is held by and only obtainable from a participant, interviews as well as questionnaires are used (Mlitwa, 2010). The current study is an inquiry into the status of ICT deployment, and its integration into the curriculum in disadvantaged schools, so as to gain insight of the status quo and its causal factors. This requires the understanding of background information, methodologies of conducting the study, policies regarding the subject of investigation, and ultimately, primary data from affected parties. Therefore, the reading and analysis of theories, methodology and background documents, as well as direct interviews are the appropriate data collection techniques for this study.

An interview is a two-way conversation in which the interviewer makes inquiries in order to collect data on the thoughts, views and opinion of the participants (Maree, 2007). Types of interviews include direct and in-depth and can be structured or semi-structured (Longfield, 2004). They can also be group or individual interviews (*ibid*). Structured interviews tend to be rigid in that they do not allow diversion from a pre-determined set of questions (Strach & Everett, 2008). This may be a disadvantage in cases where a researcher needs to pose follow-on questions on new issues that emerge from the participant's responses.

Semi-structured interviews on the other hand, allow a researcher to divert slightly from the pre-arranged structure of the questionnaire, so that they can dig deeper into emergent issues during the interview (Mack *et al*., 2005). The structure helps in ensuring that the response to interviews is relevant to the phenomenon of study, at the same time, the flexibility allows for probing to gain more insight into emergent issues (*ibid*). Semi-structured interviews are used, for example, in instances where the researcher needs to obtain the ideas or opinions of a principal in a school in regards to their relationship with the staff, learners and parents. It is within this context that semi-structured interviews are used in this study. The sources of data a further discussed below.

3.4.4. Data Sources

This study investigated the motivations for ICT integration and use in schools. For this part of the research the data source used was the literature, the data collection technique was reading and analysis of data. The units of analysis were books, journals and the Internet.

The research also studied the status of ICT deployment in SA schools, the status of ICT integration into the curriculum and explanations about the status of ICT deployment. In these instances, information was obtained from coordinators of ICT in schools as well as teachers, by means of interviews and questionnaires. The e-schools initiative policy documents produced by the government department of education were used to gain insight into the status of deployment and integration of ICT into the curriculum. The units of analysis in these instances were therefore primary and secondary schools and the Western Cape Provincial Department of Education.

Finally the research investigated the status of ICT skills among educators. This was achieved by viewing the curriculum provided by training institutions online and conducting semi-structured interviews with coordinators of ICT programs in schools as well as teachers. The units of analysis in these instances were coordinators of ICT programs in schools and teachers.
The sampling techniques and criteria for the sample selection for the current study are discussed below.

3.5. Sampling

Due to time and cost constraints it is seldom possible to include the entire population in a study (Maree, 2007). Sampling involves the selection of a workable number of participants from the research population under investigation (Babbie & Mouton, 2001; Blanche *et al*., 2006). In a sample the participants must be a representative of the population to be studied. A research population does not always refer to people but any collective phenomenon selected to form the focus of research, whether it is people, settings, artefacts, events, behaviours or social processes (Babbie & Mouton, 2001; Goddard & Melville, 2005). There are two techniques of sampling, viz. probability and non-probability sampling (Maree, 2007; Jackson, 2008).

3.5.1. Probability Sampling

Probability sampling refers to the method of selecting a workable number of participants from a population whereby the exact number and location of the population elements is known to and reachable by the researcher (Babbie & Mouton, 2001). The main aim of probability sampling is to select a set of characteristics in a way that portrays the actual parameters that exist within the overall population represented (*ibid*). Probability sampling makes use of a random selection process. With this each member of a population has an equal chance of being selected to be part of the sample (Maree, 2007). With probability sampling, concerns are more on statistical accuracy.

Since this study is not focused on statistics, but rather on an in-depth understanding of ICT deployment and its integration into the curriculum in disadvantaged schools, probability sampling will not be appropriate (Blanche *et al*., 2006). The type of sampling which is more concerned with in-depth analysis is non-probability sampling (*ibid.*).

3.5.2. Non-Probability Sampling

Non-probability sampling refers to the method of selecting participants from a population whereby the number and location of the population elements is not known to the researcher (Babbie & Mouton, 2001). This is often used in instances when the probability samples used in large-scale social surveys are not appropriate (*ibid*). An example of this instance is when sampling homeless people. In contrast to probability sampling, individual members of a population do not have an equal likelihood of been selected into the sample, random sampling methods are not used in non-probability sampling (Maree, 2007). Depending on the type of population and the particular details of an investigation, the researcher may choose any one of the four types of non-probability sampling techniques. They are; convenience, quota, snowball and purposive sampling.

3.5.2.1. Convenience Sampling

Convenience sampling refers to a non-probability method of selecting participants from a population based on their availability and convenience to the researcher (Blanche *et al*., 2006). The type of sample produced from convenience sampling is not representative enough of the entire population (*ibid*). For instance, if an interviewer conducted a survey in a shopping mall early in the morning on a given day, the people interviewed would be limited to a given time. In this instance the result of the interviews would not represent the wider views of the people in that area. Therefore a researcher cannot scientifically make generalizations about the total population. Since this study deals with real life problems in the national education systems, being able to generalise is important in this study. Therefore this sampling method is not appropriate.

3.5.2.2. Quota Sampling

Quota sampling is a non-probability method of selecting participants from a population with varying characteristics that can be divided into sub-groups (Jackson, 2008). From these sub groups, subjects or units to be researched are selected, based on the characteristics as determined by the researcher. Quota sampling however, is more statistical in nature and is mostly appropriate in research projects where statistical representation is most desired (Babbie & Mouton, 2001). The focus of this study however, is more on in-depth understanding of the problem issues of the deployment and integration of ICT into schools and into the curricula, rather than on statistical proportions. Hence, a more appropriate method of sampling is required.

3.5.2.3. Snowball Sampling

Snowballing is a method of finding participants from the population whose members' identities and location is not known and cannot be easily traced (Babbie & Mouton, 2001). For example, when sampling homeless individuals, migrant workers, undocumented immigrants, the researcher may need referrals by one member to assist him locate other participants (Maree, 2007). Due to the fact that samples gained from this procedure is generally questionable, it is mainly used for exploration purposes. This research is not an exploration, and therefore a snowball sampling method is not appropriate.

Purposive sampling offers the more appropriate methods of selecting research participants from the population that is investigated in this study.

3.5.2.4. Purposive Sampling

Purposive sampling is a method of selecting a small subset of a population based on the suitability of their characteristics to the purposes of the study (Babbie & Mouton, 2001). For example, if a person seeks to contribute to efforts made to solve problem issues of the deployment and integration of ICT into schools and into the curricula, then they will look for individuals who can assist with relevant information. Types of research such as interpretive, qualitative and explorative research require detailed analysis (Blanche *et al.*, 2006). Therefore they make use of purposive sampling.

In this research a purposive sampling method was used to understand ICT deployment, and its integration into the curriculum in disadvantaged schools in South Africa. The research used population elements such as provincial coordinators of ICT programs in school educators and school coordinators of ICT programs in the Western Cape, South Africa as a representative of the larger population. This was done in order to gain insight into the status quo and its causal factors, so as to inform remedial efforts

The research investigated: Motivations for ICT integration & use in schools, The Status of ICT Deployment in SA schools, The Status of ICT integration into the curriculum, The Status of ICT skills among educators and Explanations concerning the status of ICT deployment.

3.6. Sampling Process used for the Current Study

In choosing the area to use to investigate the access to and use of ICT for teaching and learning in disadvantaged communities in South African, the Western Cape was chosen for various reasons. One reason was that although organizations such as the Khanya Project have made efforts to deploy ICT into schools, the gap between the advantaged few in the more urban areas and the disadvantaged majority in rural areas is still evident. Clearly, the resource inequalities are more extreme in other provinces, for instance the Eastern Cape. However, the legacy of apartheid resulting in inequalities in the access to quality education is evident in all provinces especially in the Western Cape. Another reason was that the researcher has conducted previous research in the disadvantaged communities within this province and was therefore familiar with the conditions that exist and could easily access the schools.

The estimated number of schools in the Western Cape is 1530 (NEIMS, 2011). Out of the 1530 schools 1464 are ordinary and 66 provide special needs education. In terms of the regional divisions the Department of Education (DoE) within the province has eight educational districts (WCED, 2008). Schools in these districts are sub-divided into the rural and urban. The rural districts include West Coast, Cape Winelands, Eden and Karoo as well as Overberg (*ibid*). The

urban districts include Metro North, Metro South, Metro East and Metro Central (*ibid*). Four schools across the 3 urban districts were selected. One school (Kulani Secondary) was selected from the Metro Central District. Whilst two (Macassar Secondary and Marvin Park Primary) were selected from the Metro East District. The fourth school (Sithembele Matiso Secondary) selected was in the Metro South Districts. These schools were selected because the focus of the research is on schools in disadvantaged areas of the Western Cape, and these schools fall within this category.

The criteria for the selection of sample participants are presented in the section 3.6.1 below.

3.6.1. Criteria for Selection of Participation Samples

The participants selected fall into three categories of the research population:

1. the underprivileged schools,
2. coordinator of ICT and
3. unskilled teacher (not teaching ICT related subjects).

The criterion for the selection of the participation samples for the study is presented in the following table, Table 4:

Table 4: Criterion for Selection of Participation Samples

Unit of Observation	**Criteria**
1 Coordinator of ICT per school	Underprivileged Schools
1 unskilled teacher in school	Underprivileged Schools

3.6.2. Underprivileged Schools

The criterion for the selection of the 4 sampled schools was their under resourced status. Since the focus of the research is on the disadvantaged schools in the Western Cape the schools selected are located in the economically disadvantaged communities. Schools were selected from a list compiled by the DoE. Permission was requested from the Western Cape Department of Education (WCED) (Appendix D) to conduct research in these schools. Schools were contacted telephonically to ensure their wiliness to participate in the study and to gain consent from the participants. Four schools were chosen within the three districts, three secondary schools and one primary school. Two teachers were selected from each school, strictly on the basis of their representative capacity to respective research populations according to the needs

of the study as support by the purposive sampling principle. These teachers were sub-divided into two categories.

1. ICT coordinator; this category consists of educators who have been appointed to coordinate the ICT facilities in the schools. The ICT coordinators were interviewed to examine their competency level.
2. Unskilled teacher; this category consists of educators who do not teach ICT related subject. They were chosen so that enquiries could be made about the effectiveness of training programs that are set up to equip these educators with skills to use ICT in their own teaching.

Upon obtaining permission from the WCED and setting up interviews with the sampled schools, face-to-face interviews were conducted with the participants. A questionnaire was designed and used as a form of reference for the interviews. The interviews were semi-structured, therefore some question were open ended, in order to allow the participants to further elaborate on the interview questions and to provide the researcher with leading questions. Interviews were voice recorded and transcribed into a written form that was further analysed using the content analysis method (this is elaborated in the section 3.7.1, later on in this chapter).

The actual selection of participation samples for the study is outlined in the following table, Table 5:

Table 5: Selection of Participation Samples

Question	Data Source	Data Collection tool	Units of Analysis	Units observation	No. of Participants		
Motivations for ICT integration & use in schools	• Literature	• Reading • Analysis	• Books, Journals, Internet	• Methodology • Educational theories & philosophies • Computers in Education etc.		Langa: Kulani Secondary School* Gugulethu: Sithembele Matiso Secondary** Macassar: Macassar Secondary#; Marvin Park Primary#	**Schools Sampled**
Status of ICT Deployment in SA schools	• Government Dept of Education • Schools	• Semi structured interviews • Questionnaires • Reading; • Analysis	• Policy documents: Western Cape Provincial Dept of Education • Primary & Secondary Schools in disadvantaged areas of the Western Cape	• e-schools initiative policy document • 2 teacher per school • (1 Coordinator of ICT per school; 1 not teaching ICT related subjects)	4		
Status of ICT integration into the curriculum	• Government Dept of Education • Schools	• Semi structured interviews • Questionnaires	• Policy documents: Western Cape Provincial Dept of Education • Primary & Secondary Schools in disadvantaged areas of the Western Cape	• e-schools initiative policy document • 2 teacher per school (1 Coordinator of ICT per school; 1 not teaching ICT related subjects)	4		
Status of ICT skills among educators	• Teacher Training Institutions • Schools • Literature • curriculum	• Semi structured interviews • Questionnaires	• University Departments of education • Primary & Secondary Schools in disadvantaged areas of the Western Cape • Teachers	• Analyse the curriculum (online) • 2 teacher per school (1 Coordinator of ICT per school; 1 not teaching ICT related subjects)	4		
Explanations to the status of ICT deployment	• Government Dept of Education • Schools	• Semi structured interviews • Questionnaires	• Policy documents: Western Cape Provincial Dept of Education • Primary & Secondary Schools in disadvantaged areas of the Western Cape	• e-schools initiative policy document • 1 Coordinator of ICT programs per school	4		
Totals				**8 participants**: 8 teachers (1 Coordinator of ICT programs; 1 not teaching ICT related subjects)	4		

Sign represents school areas: * Langa Township; ** Gugulethu; # Macassar

3.7. Data Analysis

The interpretation of data must be led by the procedures of a specific type of analysis. During the data analysis process the researcher evaluates all data collected including, interviews, and field notes. In order to gain a clearer understanding of the information. There are different types of data analysis strategies, the main ones are: discourse analysis, conversation analysis, life histories, ethnographic accounts and content analysis.

Discourse analysis and conversational analysis are qualitative methods that focus on meanings and an understanding of language (Babbie & Mouton, 2001). Discourse analysis presents a method and perspective for analysing primarily the nature of language and its relations as well as central issues existing in the social sciences. It is a qualitative data analysis method that is concerned with language use beyond the limitations of sentence or the spoken word. Another focus of discourse analysis is on the relationship between language and society and the dialog characteristics of daily communication. This makes it not only concerned with analysis taken typically from written texts or tape recordings, but also analysis based on the human linguistic output (Brown & Yule, 1983). This type of data analysis is seen as a collection of related approaches involving a set of theoretical assumptions and a body of research claims as well as data collection and analysis (Wood & Kroger, 2000). The significance of discourse analysis is that it presents a way of engaging in a crucial human task so as to add value to life by reviewing meanings given to the spoken word. Similarly conversational analysis is found in the broader field of discourse analysis. It is the study of people talking together in the form of oral communication or language use. With conversational analysis emphasis is placed on transcripts of conversations recorded in natural settings.

Since this study is not focused on understanding languages, discourse analysis and conversational analysis methods are not used.

Similarly, narrative, life histories and ethnographic analysis methods are used to analyse stories, common themes, and the socio-cultural aspects of people (Ritchie & Lewis, 2003). Firstly narrative analyses are accounts containing elements that vary over a period of time. These accounts are brought together by a plot and contain action as well as characters. The main focus of narrative analysis is on how the world is interpreted by people through stories. Narrative analysis therefore views narratives as interpretive devices through which people represent themselves and their worlds to themselves and to others. Similarly life history analysis is a study of stories of a life gathered over a course of time. This is achieved by providing a statistical method of examining all the three aspects of life history information. These aspects include the order, sequence and timing of events. Life histories analysis method is used to identify and document. Ethnographic analysis is also concerned with the

process through which texts depict reality irrespectively of whether these texts contains true or false information. The current study is not focused on stories, but rather on real life problems encountered in the integration and deployment of ICT into school curricula. Hence narrative analysis, life histories and ethnographic methods are not appropriate.

Given the nature of data in this study, the content analysis method seems more appropriate. The type of data used in this research is descriptive data, giving information about the main causes of the issues concerning the integration and deployment of ICT into the school curricula. The study will therefore make use of a content analysis method in order to understand the data available so as to help gain relevant information which will contribute to efforts to solve problems with ICT integration and deployment into schools.

3.7.1. Content Analysis

Content analysis is the process of looking at data from different angles with the aim of identifying keywords, similarities and differences that will help the researcher to understand the descriptive content of data (Neuendorf, 2002). It works by identifying themes within the study, focusing on the way in which these themes are presented as well as the frequency of their appearances within the data (Ritchie & Lewis, 2003). The themes are words or phrases within a wide variety of text for example books, interviews and essays (Babbie & Mouton, 2001).

The type of data used in this research is descriptive data, giving information about the main causes of the issues concerning the integration and deployment of ICT into the school curricula. The study therefore makes use of a content analysis method, in order to analyse and interpret the available data, so as to help gain relevant information to contribute to efforts to solve problems with ICT integration and deployment into schools. The two ways in which data can be analysed within content analysis are namely conceptual and relational analysis.

3.7.1.1. Conceptual Analysis

Conceptual analysis is an analysis process which seeks to discover the existence and frequency of concepts (Rammupudu, 2006). This type of content analysis has a fixed set of step by step processes. The first step in conceptual analysis is to determine which words and phrases are important concepts in the study The second step is to establish the number of concepts that need to be coded, as well as the relevant key terms or codes that are be used is established. Now the actual coding process can take place. In the coding process one can choose to either look at the frequency of key concepts or simply for their existence. The next step in the conceptual analysis process is to set restrictions for each code, in other words to set rules for what sets or segments of data maybe coded. Finally an analysis of the coded text takes place. This process involves making sense of patterns and themes emerging in the available data.

This study is an in-depth understanding of the factors affecting the successful deployment of ICT into schools and its integration into schools curricula. An analysis process therefore should not only focus on discovering the existence and frequency of concepts, but also seek to determine relationships that exist between concepts and the different meanings that arise from these relational groupings of concepts. Therefore relational analysis is more appropriate.

3.7.1.2. Relational Analysis

Whilst conceptual analysis seeks to determine the existence and frequency of concepts relational analysis focuses on the relationships between concepts or data elements in a text (Babbie & Mouton, 2001). In relational analysis the coding process directs the outcome of the study (Chang, 2003). Therefore the key concepts to be coded or studied should be thoroughly examined (*ibid*). In this study the relational analysis method was used to understand the factors affecting the successful deployment of ICT into schools and its integration into school curricula. In this process the key concepts in the study were identified and presented (i.e. number of learners, number of computers, number of ICT coordinators). Related concepts were then grouped to form themes (i.e. Status of ICT Deployment and integration into schools curricula and status of ICT skills amongst educators.). The findings associated with these themes were presented firstly in relation to the status of ICT deployment into schools and its integration into school curricula, and secondly in relation to ICT skills amongst Educators. Thereafter the meanings that arose from these themes were explored and captured. This analysis process helped to inform the researcher's discussion on the status of ICT deployment as well as its integration into school curricula and its causal factors.

3.8. Ethical Considerations

The research participants in the study were not forced to partake in the study without their knowledge and consent at the time. This study therefore did not involve participants who were unable to give informed consent. The research subject did not involve discussion of sensitive topics, nor did it involve invasive, intrusive, or potentially harmful procedures of any kind (e.g. drugs, placebos or other substances to be administered to the study participants). The study did not involve prolonged or repetitive testing on sentient subjects nor were there any financial inducements other than reasonable expenses. The research did not involve environmental studies which could be contentious and the outcome will not use materials or processes that could damage the environment.

3.8.1. Ethics and Consent

As part of the requirements for conducting interviews in schools within the Western Cape, permission had to be obtained from the Western Cape Department of Education (WCED). Therefore, permission to conduct research interviews was gained from this department. The participants within the 4 sampled schools were contacted to confirm their willingness to partake in the research. Furthermore the research aims and objectives were explained in this process to ensure that the interview participants met the criteria for the sampled selection (Shenton, 2004). After the participants agreed, interviews were scheduled. The dates and times selected for the interviews took into consideration the demanding schedules of the educators. Therefore interviews were conducted at the times when teachers were less busy. On the day of the interviews the aim and objective of the research were explained to ensure that the research participants were able to make informed decisions (Mack *et al*., 2005). Participants were informed that the information requested was solely for academic purposes and therefore any information given would not be held against them. A consent form (see Appendix E: Research Participants' Consent Form) was then given to be signed by the participants in this regard.

3.8.2. Confidentiality

Anonymity and confidentiality are important aspects of ethical research practices in social research (Crow & Wiles, 2008). Therefore interview participants were assured that efforts would be made to ensure that the information provided as well as personal details pertaining to the sources would remain anonymous (*ibid*). Furthermore participants were informed that the research was purely for academic purposes therefore the information gathered would only be used towards the completion of a university Masters degree. However since the research sought to inform policy and decisions, the information could be used by affected government departments to inform developmental strategies. Additionally, research participants were informed that they could access the thesis (after completion) should they wish to do so.

3.9. Chapter Summary

This chapter provided details of the research approaches followed, the methods and techniques used to collect data, the data analysis process performed as well as the ethical issues taken into consideration in the study.

3.10. Conclusion

In this chapter the methodologies used to investigate the research problem were discussed.

While the focus of this chapter was on the research approach adopted for the study, the methods and techniques used for the data collection as well as the data analysis process, at

the same time there is a close relationship between the research methodologies in **chapter 3** and the theoretical approach as well as the framework adopted for the thesis in **chapter 4**. For instance, an e-Schools Activity Theory Analytical framework (Figure 2) makes use of the Activity Theory (AT) concepts to inform the research tool, the themes and the questions used to analyse the data.

On this point, the theoretical approach used in chapter 4 assisted in understanding and conceptualizing the research problem. At the same time the methodology chapter (chapter 3) helped in discovering the appropriate research methods and techniques needed to correctly carry out the investigative process. The research question and objective provided a basis and guideline for choosing the research methods. However the practical aspect of the research process was mainly guided by the theoretical framework (Figure 2: e-Schools Activity Theory Analytical framework). The framework was used to provide a holistic view of the phenomenon of the status of ICT deployment into schools and its integration into school curricula and to guide the analysis process.

The next chapter (Chapter 4) discusses the leading theories in Information Systems (IS) research and presents the theoretical approach adopted for this study.

CHAPTER FOUR: THEORETICAL UNDERPINNING

4.1. Introduction

The previous chapter (Chapter 3) outlined methodologies that exist within the interpretivist framework and then described those adopted in the current study.

A theory is an organized set of principles that explain real world occurrences (i.e. facts or events) (Wacker, 1998; OED, 2011). This term is also used to describe possible ways to account for natural phenomena (Gioia & Pitre, 1990).

The current study makes use of a theoretical analytical framework to understand factors of ICT deployment into schools and its integration into school curricula. A theoretical framework therefore provides a lens through which a research phenomenon is viewed.

The theoretical framework in this chapter provides a practical and conceptual model for carrying out the methodologies and research approaches discussed in chapter 3.

The chapter opens with an outline of the leading theories in Information Systems (IS) research (section 4.2). These theories are further elaborated upon in sections 4.3 and 4.4. The theoretical approach adopted for the study is then explained in the section 4.5. Then the application of this Activity Theory framework to the e-schools work-activity framework is discussed in the section 4.5.1. The conclusion of the chapter is presented in the section 4.6.

4.2. Theoretical Underpinnings

The use of theories, either as a means of analysis, or with the objectives of validation and development, has been a general practice in IS research (Kaplan *et al*., 2004), with over 154 theories noted in various IS journal publications in 2009 (Lim *et al*., 2009). Within IS research the dominance of some theories within their respective paradigms, is also reported (*ibid*). In the interpretive paradigm, the Actor Network Theory (ANT) has been ranked as the most commonly used theory, followed by the Structuration Theory (ST) and the Activity Theory (AT), in the top ten most favoured theories, in IFIP WG8.2 IS Publications (Flynn & Gregory, 2004).

4.3. Actor Network Theory

A leading sociological theory within the interpretive research paradigm is Actor Network Theory (ANT) (*ibid*). This theory aids in understanding the social and technical aspects of a socio-technical interaction (Mlitwa, 2011). ANT is commonly known for its view that individuals or organizations share the same level of importance within a social network (Latour 1987). Central to ANT is the concept of heterogeneous networks. This stems from the idea that a network can contain different elements (i.e. social and technical) (Ritzer,

2005). Thus networks have two parts, namely social and technical. A social network is primarily considered to be a group of people or an organization, whose structures are connected by social relationships (Ritzer, 2005). Consequently a socio-technical network is inclusive of technologies that are constructed by people and use collaboratively (Lamb & Davidson, 2002). Each function in a socio-technical network has an important influence on the output of the network. Therefore within such a socio-technical network, both the social (i.e. individuals or organizations) and technical (i.e. technological) aspects are viewed as equally important (Lamb & Davidson, 2002). The importance of a network therefore, is the process whereby both human and non human (artefacts) actors have a shared influence in the network process (Fox, 2000). ANT presents network connections between all socio-technical factors. The focus of ANT is on individuals, organizations and social institutions (Lamb & Davidson, 2002).

In research, ANT is frequently used to inform Information System (IS) studies (Cordella & Shaikh, 2006). As a comprehensive theory it has been used to investigate technology and the construction of technological artefacts in society (Elbanna, 2009). ANT has been used in the past to analyse the causes of failure in national ICT integration into schools programs. An example is a study by Elgali and Kalman (2010) whereby the application of ANT to the national program and local ICT integration programs helped to identify the failures and their causal factors. This was achieved by analysing the differences within the networks between the two programs.

The focus of the current study however, is not on the importance of human and nonhuman elements in a network but rather on how remedial efforts can be informed by investigating the mediating factors that can assist in realizing the goals of the stakeholders (i.e. DoE, e-School Coordinators, educators, teacher training colleges and schools). For this reason, a more systemic approach would be more appropriate. Discussed below is another leading social theory, Structuration Theory (ST).

4.4. Structuration Theory

Structuration Theory (ST) presents a means to understanding production and reproduction of social practices over time and space (Giddens, 1984). This theory seeks to describe social practices consisting of individuals and social activities (Johnson, 2008). It can be best defined by its basic concepts: agent, agency, structure, duality of structure, structuration, modality, social system, structures of: signification, legitmation, and domination, system integration, social integration, time and space distanciation as well as routinisation which are described in the following section.

In ST a human being is an agent however not all agents are human beings (Stillman, 2006). Furthermore the action which these agents perform is referred to as an agency (Yates, 1997). Rules (i.e. guidelines which people follow) and resources (i.e. effects of human actions) are called structures (Orlikowski, 1992). Duality of structure means that, social structures make social actions possible at the same time as the social actions create those very structures (Yates, 1997). The structure created by an agency is a medium for the transmission of an agency (Giddens, 1984). Duality is therefore the medium for the transmission of recursive and recurrent social practices (*ibid*). Through this process social agents through continuous interactions make sense of rules and practices (*ibid*). Structuration is the process in which the duality of structure evolves and is reproduced over time and space (Giddens, 1984). By means of these structuration agents, through their actions, continually produce, reproduce and create the social structures that constrain and enable them (Fuchs, 2003). The transformation of structure into actions is made possible by a medium called modality, where agents, by creating interactions, initiate the activities within a social system (Sydow & Windeler, 1998). A social system can therefore be understood by its modality, interaction and structure (*ibid*). The types of structures in social systems are those of signification, legitimation and domination. Firstly signification creates meaning through organized sets of languages (Jones & Karsten, 2003). An example of these languages is a semantic code (*ibid*). Secondly legitimation produces moral order by conforming the societal norms, values and standards to that of the natural order (Sydow & Windeler, 1998). Finally domination is an exercise of power gained from the control of resources (*ibid*). System integration is relations between agents that are absent (i.e. physically or temporally situated in different settings) are referred to as system integration (*ibid*). Social integration refers to real life interactions between agents that seek to preserve a concern for system integration (Mavridou, 2003). The social and system integration mechanism enables social systems to grow over time and space by a process called time space distanciation (*ibid*). Finally the norms or habits are referred to as routines. Thus the establishment of norms and habits is referred to as routinisation.

ST focuses on social practices that are composed of mutually interactive individual and societal activities (Fuchs, 2003). It assumes that *"we create society at the same time as we are created by it"* (Giddens, 1984). A structure is therefore said to be activity-dependent. What Giddens calls the "double hermeneutic" principle or the joint involvement of society and individuals, further informs the production and reproduction of practices over time and space. ST suggests that human action is carried out within the framework of pre-existing social structures ruled by norms or laws (Berends *et al*., 2003). These structures may be rules and resources that individuals require to accomplish their day to day work activities (Orlikowski, 2000). In this regard every human action is predetermined by the rules under which they occur (*ibid*). These rules are in turn maintained and adjusted by human action. ST argues

that structures do not exist separately from human agents, because it is human agents who reinforce existing structures through their actions (Giddens, 1984). ST is used to understand *"what sort of things are out in the world rather than what is happening to or between them"* (Craib, 1992: 108). It therefore deals with social phenomena at a high level of abstraction.

Structuration theory (ST) is mostly concerned with addressing the transformation of social systems. In research ST can be used as a focus lens through which organizations are viewed. An example of such research is by Orlikowski (2000) entitled *"technology and constitutions structures: A practice lens for studying technology in organizations"*. In his study Orlikowski proposes a structurational view of technology that is developed and is used as a practice lens to discover how people, as they interact with technology in their own way, create structures which form emergent and situated use of that technology. Another example of the use of ST in research is Stillman's (2006) thesis which is *"a study off the understanding of technology in the lives of community workers in Neighbourhood houses, a type of small community organization"*. In his thesis Stillman (2006) makes use of ST to *"demonstrate the significance of particular normative frameworks to workers in forming attitudes about how common personal computer technologies and the Internet are utilized*" (*ibid*).

The current study explores the status of ICT deployment and its integration into schools' curricula. It seeks to understand the inequalities regarding access to quality education within disadvantaged schools, with emphasis on the causal factors, so as to inform policy and decision. Since this study does not focus on social structures or on human actions at the abstraction level of ST, a more appropriate theory for the study, namely Activity theory is presented next.

4.5. Activity Theory

As indicated by Engeström (1987), activity theory (AT) is built on Vygotsky's (1978) concept of mediated action. In his original model Vygotsky promoted duality of the individual and their social environment by associating human actions with cultural artefacts. Here an activity was viewed as a biological process of stimulus and response formulation that entailed only an act of mediation. The unit of analysis in the early stages of the application of AT was on individual activity/ies or practices (Vygotsky, 1978). In recognizing the limitation of a purely individual focus (Uden *et al*., 2008) Engeström (1987) through the influence of Leont'ev's (1978) view on the mediation of other elements in an activity system - proposed that tools/artefacts should be an important aspect of a human activity. Therefore "…*the focus of the study of mediation should be on its relationship with other components in an activity system*" (Engeström, 1987: 29).

As informed by Engeström (1987), Activity Theory deals with the processes that lead to social transformations. Failure and conflict therefore form the reason for transformation and improvement (Hardman, 2005). AT is used as a framework for examining and transforming networks of interacting activity systems (*ibid*). As part of the developmental process, activity systems transform one condition to another and thus are instruments of reorganisation (Engeström, 1987). The basic components of an activity system are comprised of the subject, object, mediating artefacts (i.e. tools), rules, community and division of labour (*ibid*). The subject is an individual (actor or actors) from whose perspective an object is to be viewed (Daniels, 2004). An object is the reason for an action, in other words the goal (Engeström, 1987). Mediation is concerned with the use of tools to mediate human activity (Vygotsky, 1978). The tool is the artefact to be created and transformed during the development of the activity itself (Uden & Damiani, 2007). Rules are the cultural norms and regulations which can be either implicit or explicit and influential in the activities that take place (Engeström, 1987). The community represents groups, as well as rules and arrangements such as the division of labour (Owen, 2008).

The focus of AT is on the interaction between human activity, objects or goals and mediators within the appropriate context (Vygotsky 1987). An activity is seen as a factor that ties the actions to the context, hence an activity is a basic unit of analysis in Activity Theory (Engeström, 1987). Since human actions derive their meaning from the context, *"actions without context are meaningless"* (Mursu *et al*., 2007: 6), actions must be viewed within a context (Leont'ev, 1978). Rather than a predicted theory, AT is a descriptive framework which can be considered a concept and a theoretical approach or a viewpoint (Mursu *et al.*, 2007). In most instances AT is used to analyse human activity from a needs-based and goal oriented viewpoint (i.e. people are driven by needs and therefore have specific goals to achieve) (Mlitwa, 2011). Consequently it is used to understand human interaction through mediated tools and artefacts (Hashim & Jones, 2007).

AT has been used in previous studies to investigate the integration of ICT into schools. For example, in their research Lim and Hang (2003) made use of activity theory as a framework to study the ICT integration process in Singapore schools. This investigation was made from both a socio-cultural and pedagogical perspective. Similarly Demiraslan and Usluel (2008) in their research focus on issues and contradictions affecting the ICT integration process in Turkish schools from an Activity theory perspective. Likewise the current study seeks to understand the factors affecting the successful deployment of ICT into schools and its integration into school curricula, so as to inform remedial efforts. Therefore AT is used as the theoretical approach for this study because the context of this study is similar to the previous studies mentioned above.

The next section (section 4.5.1) elaborates further on how AT is an appropriate approach to use in the current study.

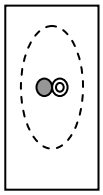
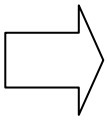
4.5.1. The Use of Activity Theory in this Research

Looking at the objectives of the current study, the Activity Theory (AT) enables the researcher to conceptualize the research aims and outcomes. As indicated in Figure 2 (in the later section) the AT work-activity concepts are used to present the e-Schools programme as an activity system. These concept include the; actors, motives/goals, mediators, activities/actions, transformations and outcomes.

From the work-activity system perspective, an actor is an individual or a group of people (Engeström, 1987). The motives/goals refer to the objectives to be achieved by the various actors within the activity system (*ibid*). Mediators are factors as well as tools that can enable or inhibit the successful achievement of a goal (Vygotsky, 1978). Activities/Actions are tasks that need to be carried out by the various actors within the work-activity system (*ibid*). The transformation process combines the enabling factors, the tools and the activities, in order to achieve a positive outcome (Uden & Damiani, 2007).

The relevance of AT in this study is that it provides a summarized view of the phenomena at hand. From an AT perspective the e-School Activity Theory Analytical framework (Figure 2) aids in understanding the factors affecting the successful realization of the government's e-Education policy goal (i.e. universal access of ICT for teaching and learning). The work-activity system (Figure 2) presents the actors at institutional and individual levels, their goals as well as the activities and the mediating factors that can aid in achieving these goals. Below is a legend for the analytical framework in Table 6.

Table 6: Legend for the e-Schools Activity Theory Analytical Framework

	Institutions
	Educational Organisation
	Individuals
	Work Flow

The AT work-activity concepts are used to present the e-Schools programme as an activity system in Figure 2 overleaf.

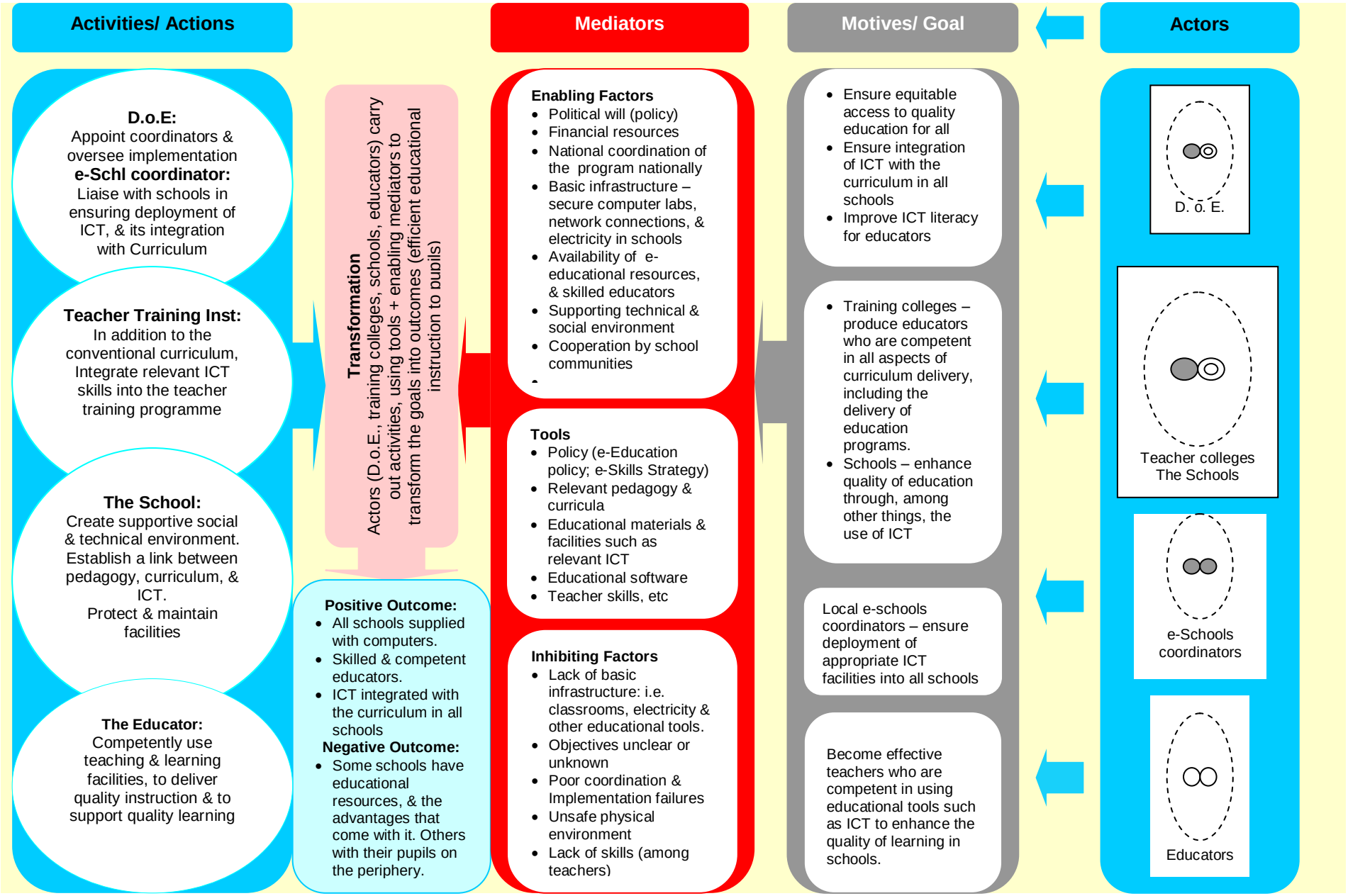


Figure 2: e-Schools Activity Theory Analytical framework

Figure 2 draws on the activity theory to presents the e-schools program as work-activity in the activity system. From the activity system perspective, six key terms determine the work-activity (the activity of deploying ICT, and integrating it with the curriculum in schools). The work activity involves **actors**, **goals**, **activities**, **mediators**, **transformation** as well as the **outcome**. Information flows and linkages between the six components of the activity system are important in the success of the work-activity.

The actors in the e-schools work-activity are numerous but the most predominant ones in this study are, at the institutional level, the Department of Education (DoE) as represented by the national and provincial ministries, teacher training colleges, and the actual schools. The main actors at the individual level are the e-Schools coordinators and the educators. The goals are conceptualized in terms of the objectives of the national e-Education Policy which provides for the deployment of ICT, and its integration into the curricula in all South African Schools. These goals are in turn sub-divided into institutional and individual goals. Actors need to carry out their respective activities, using the appropriate tools in their respective contexts, to achieve these goals.

With regards to the goals to be achieved at institutional levels, the DoE for example, aims to ensure equal access to quality education for all. This department also seeks to ensure the successful integration of ICT into school curricula and to improve ICT literacy amongst educators. The teacher training colleges on the other hand aspire to produce educators that are competent in the various aspects of curriculum delivery as well as in teaching and in using ICT-related educational programs. Lastly the schools aim to enhance the quality of education and to promote the use of ICT for teaching and learning. At individual levels the e-Schools coordinators seek to ensure the proper deployment of ICT facilities into all schools. Finally the goal of the educators is to become effective teachers who are competent in using educational tools such as ICT to enhance the teaching and learning process in schools. As stated in Figure 2 however, success or failure in the realization of these goals is determined by the interplay between the enabling and the inhibiting mediating factors. Enabling mediating factors include political will, financial resources, skilled educators, availability of e-Educational resources and a supporting technical as well as social environment. It also requires tools such as relevant ICT and pedagogy, educational materials as well as software etc. Additionally, stakeholders are required to carry out their various activities. The DoE for example, is required to appoint coordinators and oversee implementation. The e-Schools coordinators on the other hand are required to liaise with schools in order to ensure the deployment of ICT and its integration into school curricula. The teacher training institutions are required to integrate relevant ICT skills into their training programs. With the Schools, their required activity is to create a supportive social and technical environment, establish a link between pedagogy, curriculum and ICT, and to protect as well as maintain facilities.

Lastly the educators are required to competently use teaching and learning facilities, to deliver quality instruction and to support quality learning.

These mediating factors, along with the activities to be carried out by the various actors can aid in transforming goals into positive outcomes. They also provide an ideal situation for the e-Education policy goals to be carried out. In essence, an example of political will in an ideal situation would be governmental plans in the form of policies (e.g. e-Education policy), that outline strategies to implement ICT into schools and to integrate it into school curricula. This policy should ideally be supplemented with clear guidelines for implementation. Furthermore, there should be evidence of its implementation and enforcement. With regards to financial resources, another mediating factor, ideally governments along with private organisations should financially support the goals of ICT deployment and its integration into school curricula. This support can be provided in the form of monetary funds or the donation of ICT facilities (such as computers, educational software, copiers, printers, scanners and projectors etc.). Skilled educators, in an ideal situation, would be teachers that are trained on how to teach using educational programs in the full school curricula. These teachers should further be able to teach subjects using both simple and complex educational programs (i.e. Master Maths, Cami Maths, KVerbos, MindGenuis and StressAlyzer etc.) Furthermore, a supporting social environment entails the willingness of the affected parties (i.e. schools, principals, teachers and learners etc.) to make use of educational ICT (i.e. computers, educational software, printers, copiers and Internet etc.) to support the teaching and learning process. An ideal supporting technical environment is one in which buildings have adequate infrastructure (such as electricity and telephones etc.) to sustain the deployment of ICT. It also entails availability of ICT competent individuals that can coordinate the ICT resources in the schools and possibly provide technical support services to sustain and maintain these resources.

In the case of South Africa the situation is that an e-Education policy has been created to ensure equal access to ICT in schools. Although the government has taken good steps by creating a policy, inhibiting factors such as a lack of educational tools, unclear objectives, poor policy coordination amongst others, can result in a negative outcome of the goals of the actors within the activity system. These inhibiting factors can negatively affect the status of ICT deployment and its integration into school curricula, as discussed in Chapter 5.

In summary the framework (Figure 2) provides a focus for the study and helps to conceptualize the research aims and objectives. It further aids in defining the concepts that ultimately shape the data-collection process in this investigation.

4.6. Conclusion

Discussed in this chapter were the leading theories in IS research. The theoretical approach adopted in the study is the Activity Theory (AT). AT helps to understand the situation under

investigation. From an activity theory perspective, the government e-Educational policy goal (deployment of ICT into schools and its integration into school curricula) is conceptualized and presented as the e-Schools activity theory analytical framework (Figure 2). This framework helps the researcher to understand the factors affecting the successful deployment of ICT into schools and its integration into school curricula. Within the e-Schools program work activity system, the goals of both individuals and institutions can be transformed into positive outcomes with the aid of mediating factors as well as activities.

The e-Schools program work-activity system is used to guide the analysis process in the next chapter (Chapter 5).

CHAPTER FIVE: RESEARCH FINDINGS

5.1 Introduction

The aim of this study is to investigate the deployment of ICT into schools and its integration into school curricula. The process is to understand the status of ICT resources and the quality of education for learners in disadvantaged communities as well as the causal factors of discrepancies that exist between these and other communities, so as to inform those who are seeking solutions to minimize these discrepancies.

The research question, thus raised was: “How can the discrepancies of the status of ICT deployment and its integration into the curriculum among disadvantaged schools in the Western Cape, South Africa be addressed?” This question was divided into sub-questions:

1. What is the status of ICT deployment in disadvantaged schools in the Western Cape?
2. How can ICT be deployed into disadvantaged schools?
3. Why should ICT be deployed into disadvantaged schools?
4. Why has ICT not been deployed into disadvantaged schools?
5. How does the disadvantaged situation in schools impact on the adoption of ICT?
6. Why do teachers not integrate ICT into the curriculum?
7. How do people and institutions for instance, principals, government bodies and teachers, influence the adoption of ICT in to the school curriculum?
8. How does the policy in terms of implementation relate to the current situation in disadvantaged schools?

To aid this investigation, 8 participants from 4 schools within disadvantaged communities in the Western Cape were interviewed. The schools were: Macassar Secondary, Marvin Park Primary, Sithembele Matiso Secondary and Kulani Secondary. Individual interviews were conducted to collect data. Research participants were sub-divided into ICT coordinators and teachers.

Drawing from the e-Schools Activity Theory Analytical Framework in Figure 2, the stakeholders in this research are broken down into 4 actors: DoE, Teacher Colleges and schools, e-School coordinators as well as educators. This framework is used to frame the research question, according to the goals of these actors, in the e-Schooling process. The logic of this framework is also integrated into the analysis and interpretation of data, under the findings.

In this process, relational analysis with a focus on relationships between data elements is used as a type of content analysis (Babbie & Mouton, 2001). The required initial step used in

the analysis process of the study, is the inquiry into existing research data sets (Boakye, 2009). Information gained from this inquiry process can answer questions that arise in the data analysis (*ibid*). Making distinctions between possible research questions therefore allows for more focus and clarity on what is to be examined in the data analysis process of the research (Chang, 2003). The next step in the relational analysis process involves the recognition of actual analysis data. After this the level, as well as the type of analysis to be used, is determined through a conceptualization process (Chambers & Gopaul, 2008). From this point onwards, texts are categorized into themes as well as codes for words and patterns are sought (Busch *et al*., 2005). An exploration into the relationship strength must be made (*ibid*). There after these relationships are also, coded in order to create a presentation of qualitative data collected. The relational analysis process was applied in this thesis by firstly developing three key themes: (viz. ICT Deployment, ICT integration and ICT teacher skills). After that, colour coding was applied to each transcript where specific responses were colour coded according to the themes. There after answers that fell within the same theme (in other words, answers that had the same colour) were grouped together. The colours were used to translate the theoretical concepts. A theoretical framework as well as research questions was drawn upon to develop the themes. After that colour coding was used to distinguish between the themes. Different types of codes were given according to different answers found. Thereafter answers which fell in the same colour code were identified and relationships were formed in this process.

This chapter begins with background information to inform the status of ICT deployment and its integration into school curricula in section 5.2. Findings relating to the physical deployment of ICT into schools and its integration into school curricula are then discussed in the sections 5.3, 5.4 and 5.5. This is followed by a presentation of the findings relating to ICT skills amongst educators in the section 5.6. A discussion of findings is provided in section 5.7. The final section of the chapter is 5.8.

5.2 International Comparative Perspectives

It is because of the perception that a learner is able to benefit from the efficiencies of a computer with more individual focus, that organizations such as One Laptop Per Child (OLPC) have developed a project, which seeks to ensure that every school-aged child in developing countries is able to effectively engage with their own personal laptop. In terms of the feasibility of the project, it is not affordable, neither in developing nor under-developed countries. For this reason, calls for a more feasible ratio of learners per computer are made, with developed countries suggesting such a ratio to be calculated per capita of learners, according to each country's economy (James, 2010). According to the per capita logic therefore, the ratio of learners per computer for developed countries such as the United Kingdom (UK), New Zealand and Norway should be 6 learners to 1 computer, (The Daily,

2002), 5 learners to 1 computer in Australia, New Zealand and Norway, and either 4 or 5 learners per computer in the United States of America (USA) (U.S.A. DoE, 2000).

However, using the per capita measure as a standard tends to be problematic when translated into developing and under-developed countries in that it would translate into an unreasonably larger student to computer ratios. In this instance developing and under-developed countries such as Malawi, Nigeria and Kenya, with a lower income per capita, the ratio of learners per computer is as high as 312 to 1 (James, 2010). Clearly, looking at the importance of individual focus on computing tasks this ratio indicates that the 312 learners cannot fully benefit from the efficiencies of using a computer if they have to share only one computer. Despite the difficulties encountered when trying to provide for every individual's needs, there are cases where one or more of the 312 learners need to type an assignment or perform individual learning tasks. It would be very difficult to achieve these tasks when sharing a computer between 312 learners, even worse is if all 312 learners have to learn using a subject specific learning program. These are the reasons why the ideal number of learners per computer is 1 to 1. A further problem with the per capita income measurement is that it tends to be technical rather than needs-focused. A needs focus approach for example, refers to what would be the practical ideal for improving the learning experience of the student. In this instance, a much lower ratio would make sense. On this point, developed countries have recognized the importance of reducing the learner / computer ratio. Instead of a per capita mentality, they have set the standard of learners per computer in the region of less than 5 learners per computer (U.S.A. DoE, 2000). Although ideally this number should be 1 learner per computer (OLPC, 2005). This allows for individual learners to fully benefit from the efficiencies of using a computer because frequently the requirement for the completion of an assignment can be access to relevant information and typing up this information. To perform these tasks effectively learners require individual focus on their project and having their own computer would help in the successful completion of the assignment. Therefore, 5 learners sharing 1 computer is a major compromise when compared with what can be gained from having 1 computer per learner. Although 5 to 1 is a major compromise, it is still better than the ratio of 312 learners per computer in underdeveloped countries, which is far off the standard at which learning using a computer becomes beneficial and useful (Roschelle & Pea, 2002).

By creating the e-Education policy the South African government shows that it recognizes the importance of universal access to ICT. However the success of implementing this policy is questionable when looking at the summary of findings in Table 7 below. These findings are presented fully in sections 5.3, 5.4, 5.5 and 5.6.

5.3 Findings: Status of ICT Deployment into Schools and its Integration into Curricula

Summary of findings is presented in Table 7, overleaf and elaborated in detail in the sections that follow.

Table 7: Status of ICT Deployment & its Integration into Curricula

Name of schools	# of Learners	# of Computers	# of ICT Coordinators	# of Computers Working	# of Computers with Internet	Subjects with Computer Programs	Computer Programs	Explanation
Kulani Secondary	+- 800 (KH_B30)	+- 38 (KH_B29)	1 (KH_M5)	+- 33 (KH_B35)	None (KH_B4)	**One:** Maths (KH_B49)	Master Maths, for all school grades (KH_B5)	• Computers were donated by Khanya Project (KH_B25) • Reason for lack of Internet Unknown (KH_B38) • Reason for number of subjects with computers programs, maths is the only subject that has a learning program at the school, reason for lack of learning programs for other subjects is unknown (KH_B49) • Whether there are financial resources to support the deployment and integration of ICT into schools' curricula: the school relies on projects such as Khanya to provide computers (KH_B32)
Macassar Secondary	+- 700 (MC_F27)	+- 97 (MC_F19)	2 (MC_F1)	+- 67 (MC_F29)	+- 67 (MC_F32)	**+- Four:** Maths, computer application technology, life orientation, sometimes languages & geography (MC_F20, MC_F22)	Master Maths, Computer application technology, GIS and PACE (MC_F21, MC_F22)	• 60 computers were donated by the DOE, and 30 by USSASA (MC_F19) • Whether there are financial resources to support the deployment and integration of ICT into schools' curricula: the school has some financial means to acquire and maintain ICT resources however it is limited (MC_F29) • Reason for number of subjects with computer programs, not enough skilled teachers (MC_F1)
Sithembele Matiso Secondary	+- 1370 (SM_D22)	+- 25 (SM_D21)	3 (SM_D51)	+- 18 (SM_D25)	None (SM_D27)	**Two:** Science & maths (SM_D35)	Master Maths & Multi choice (SM_D9)	• Computers were donated by Khanya (SM_D1) • Reason for lack of Internet, the server is not working (SM_D27) • Reason for number of subjects with computer programs not enough computers (SM_1D) • Whether there are financial resources to support the deployment and integration of ICT into schools' curricula: the school does not have enough financial resources to purchase its own computers (SM_D53)
Marvin Park Primary	+- 1185 (MV_F36)	+- 36 (MV_F27)	3 (MV_F65)	+- 36 (MV_F37)	2 for admin use only (MV_F45)	**Three:** Science, Maths & English (MV_F62)	Cami Maths, Litnum (MV_F4)	• Computers were donated by Khanya (MV_F29) • Reason for lack of Internet, it is not affordable (MV_F45) • Reason for number of subjects with computer programs, lack of finances (MV_F21) • Whether there are financial resources to support the deployment and integration of ICT into schools' curricula: the school lacks financial resources (MV_F45)

5.3.1 Deployment of Computers into Schools

The goal of the third actor in the analytical framework (Figure 2), the e-Schools coordinators is to ensure deployment of appropriate ICT facilities into all schools.

A successful realisation of this goal (physical deployment of ICT), according to the framework presented in chapter 4 (Figure 2), depends on interaction between activities, the mediating factors and the transformation process. One of the mediating factors is the political will. This is supplemented by cooperation (clear channels of communication, clear processes and resources) between the DoE and school communities, the availability of financial resources as well as a supporting technical and social environment. Success also depends on tools such as ICT, software programs and relevant educational materials, etc. Finally to aid the successful deployment of ICT into schools, various stakeholders (DoE and e-School Coordinators) need to vigilantly carry-out their respective activities. With regards to the DoE, competent coordinators need to be appointed to oversee policy implementation. In Schools it is the e-School coordinators who are required to competently facilitate the availability and functionality of ICT in the learning environment.

With regards to the deployment of ICT into schools, according to the findings in Table 7, the learner to computer ratio ranges from the privileged few with a low learner to computer ratio, to an unreasonably high ratio to a situation where there are learners who have no access to any form of computer.

5.3.2 Schools with low learner / computer ratios

The findings in (Table 7) reveal a disappointing learners computer ratio. This situation brings into question, the success of the e-Schools coordinators' goal of bringing about the physical deployment of ICT into schools. Out of the 4 schools, Macassar Secondary has the lowest ratio of 10 learners per computer (MC_F29), followed by Kulani Secondary with a ratio of 24 learners per computer (KH_B35). Although Macassar has the lowest learner computer ratio in comparison to Kulani and the other schools in the sample, the ratio is still not as low as the ideal ratio of 1 learner per computer or the compromised standard of 5 learners to 1 computer that has been adopted in developed countries.

According to the framework (Figure 2) the inability of the stakeholders (e-School coordinators) to achieve their ICT deployment goal indicates government and institutional failure to implement the noble-intentioned e-Education Policy. In terms of political will, as a mediating factor of the e-Schools coordinators' goal (physical deployment of ICT), the e-Education policy is an enabling vision for the deployment of educational ICT in schools. However unless the implementation is competently coordinated, the vision alone can not yield the hoped for positive outcome. On this point, the framework in Figure 2 emphasises how important cooperative coordination is in the implementation of the e-Education

framework. In other words, facilitative interaction between national, local and school communities becomes fundamental. It was interesting to note that respondents did not know what the practical aspects of implementation were. An example is the teacher laptop initiative, which according to the participants, had not been successfully implemented since its inception (KH_B22; MC_F14). At best, only a few participants were aware of the government's intention to attempt to deploy ICT into schools (MC_F3; KH_B22). This lack of knowledge implies a break down of clear channels of communication, and a marked uncertainty with regard to the carrying out of processes.

Financial resources and an enabling socio-technical environment are highlighted as the major mediating factors in the activity theory framework (Figure 2). On this point, a lack of financial resources is frequently cited as the main inhibitor (MC_F29; KH_B32). For example, only Macassar Secondary had some means (albeit, limited) to acquire and maintain ICT resources (MC_F29). The only notable action carried out by the DoE was the appointment of ICT coordinators to oversee implementation in both Macassar Secondary and Kulani Secondary (MC_F1; KH_M5). Although these 2 schools have ICT coordinators, it is only with a supporting financial budget that coordination can succeed. In terms of the activities of the coordinators, competencies were also not apparent. Whilst the goal is to coordinate the physical deployment of computers, Internet and related programs (including arranging finance with the national stakeholders) success remains elusive. For example, as has already been noted, the learner computer ratio in Macassar and Kulani did not meet the ideal standard of 1 learner per computer nor even the 5 learners per computer standard, set by the developed countries. A lack of interest among local school communities also implies that coordinators are not communicating with school leaders, which makes one wonder, whether the role of coordinators is, in effect, clearly defined. A lack of ICT therefore means that affected learners will continue to receive a sub standard education, which may possibly have a negative impact on a learner's performance later at tertiary level or on their chances of being employable.

With ICT being an enabler of the teaching and learning processes (Diouf & Ngamo, 2010), measures need to be taken to ensure its successful deployment into schools, with the ultimate aim of to transforming the goals of ICT deployment in schools into positive educational outcomes. Whilst the goal of the e-School coordinator is to ensure the deployment of appropriate ICT facilities into schools (Figure 2) for example, a successful realisation of the physical deployment goal requires political will. This goes beyond merely providing a policy. It requires cooperation (clear channels of communication, clear process and resources) between the DoE and school communities. With this goes with the need for adequate financial resources and a supporting technical and social environment as well as tools such as educational material, relevant pedagogy and curricula. Although a policy (e-Education) exists, without practical steps to implement this policy, it will not be able to

become a reality. Regrettably, the findings indicate that there is a lack of awareness of the practicalities of the implementation of the policy amongst educators (KH_B22; MC_F14).

This problem is more evident in schools with an even larger learner to computer ratio. These schools: Marvin Park Primary, Sithembele Matiso Secondary are discussed in the section 5.3.3 below.

5.3.3 Schools with very high learner/computer ratios

Whilst the learner per computer ratio is between 10 and 24 at Macassar and Kulani secondary schools, the situation is worse at Marvin Park Primary and Sithembele Matiso Secondary. Marvin Park has a ratio of 33 (MV_F37), which is the second highest ratio after Sithembele Matiso where the ratio was as high as 76 learners per computer (SM_D25). The idea of these 33 learners sharing one computer can lead to non-completion of individual learning tasks, and ultimately, stagnation in academic progress. On the other hand, although the ratio of 33 and 76 may be numerically lower than the ratio of 312 in many underdeveloped countries, these are a long way from the ideal ratio of 1 and the compromised ratio of 5 set by the developed countries. Consequently with the challenges of learning and the pressure of assignment deadlines, the practicality of 33 learners sharing 1 computer is questionable. At 76 learners per computer, it is even harder to imagine the integration and application of ICT into curricula that require learners to complete tasks individually.

With the quality of education in underdeveloped areas of South Africa being dominated by the low matric pass rates and high computer illiteracy (South Africa.info, 2011), a general belief is that ICT would contribute towards the improvement of the quality of, and equity in, education. According to the framework (Figure 2), the apparent lack of resources in disadvantaged schools implies a continuation of the status quo[12]. This leads to affected learners missing out on the educational solutions offered by ICT - with a negative impact on the quality of learners entering tertiary institutions, entering the job market, and ultimately, on the pace of economic development and growth (Blackburn, 2008).

In providing reasons for high learner computer ratios in the sampled schools, educators at Macassar Secondary mentioned that a lack of finance was the main inhibitor of the acquisition of ICT (i.e. Internet, computers and educational software etc.) in the school (MC_F48; MC_P14). As a result of the high learners computer ratio, access to and use of the ICT facilities were limited (MC_P11). This meant that teachers could only teach using subject specific ICT-related learning programs on a maximum of 2 out of any 7 day cycle (*ibid*). The

[12] In terms of the status quo, only 15% of public schools had computer and science laboratories in 2009 (DoE, 2009). Further, such limited availability and use of computers present situations whereby learners lack ICT skills. As such, most learners in affected areas are unable to perform computing tasks which require individual attention later at the workplace or at tertiary institutions (Blackburn, 2008).

learner computer ratios mean that learners will not be able to fully profit from the benefits that a computer provides (i.e. higher quality of learning, encourages anytime and any place learning). To this effect an educator expressed that learners were not adequately exposed to educational technologies (MC_P16). Also with the inadequate learner computer ratio of some learners face the risk of never having access to a computer at the school (i.e. educational software, Internet and computers etc.) (*ibid*). This lack of exposure was reflected in the poor computer literacy rate amongst learners at this school (MC_F42). Similarly at Kulani Secondary School, participants mentioned that there were not an adequate number of computers for teaching and learning. Reasons for a lack of computers at this school were unclear or unknown (KH_B32; KH_M26). According to the ICT coordinator, the organization responsible for placing the computers in school, states that the number of computers can only be increased if the computers already in the school are fully utilized. The definition of full utilization of computers was unclear, as the educators were unaware of what practical steps needed to be taken to achieve the full utilization goal. A lack of ICT at this school meant that learners did not use computers in a range of subjects, the only subject they used a computerised learning program was maths. On this point one educator mentioned that teachers were eager to teach other subjects using the relevant ICT-related educational programs (KH_M1). From this educator's perspective ICT is a significant enhancer of the teaching and learning process. Hence, it would be beneficial if it were integrated into the full curriculum (KH_M6; KH_M7). An educator (MC_P13) felt that there was a desperate need for an intervention to rectify the lack of resources available at the school so as to improve the teaching and learning process. With the disadvantaged status of the schools a lack of resources (i.e. ICT, classrooms and skilled teachers etc.) resulted in highly over crowded classrooms. For example, one class could consist of over 60 learners (MC_P13). This led to problems as teachers experienced difficulties in gaining the attention of the learners. As a result the educator felt that ICT could aid in providing educational solutions for the learners and the lack therefore had a negative impact on the quality of the educational content delivered (*ibid*).

Since the 2 sampled schools were located in disadvantaged areas, without financial resources, they would need institutional support in terms of sponsorship to obtain ICT facilities. Furthermore, factors such as an unsafe physical environment can prevent the successful deployment of ICT into schools as the findings show in this study (Figure 2). On this point, 2 teachers indicated that their respective schools were located in unsafe physical environments (MV_K22; SM_M32). With the ratio of learners per computer being far from favourable, an unsafe physical environment means that this ratio could become even worse because these ICT resources often get stolen or vandalized.

Despite the noble policy intentions in the form of the National System of Innovation (National system of innovation, 2002) and the e-Education policy (DoE, 2003) by the government, a

lack of resources clearly suggests discrepancies in terms of implementations (resourcing of schools with computers and Internet). With regards to the Internet, its availability and access to it in the 4 sampled schools are discussed in section 5.4 below.

5.4 Access to, and use of, the Internet in Schools

In the sampled schools not only were the student to computer ratios high but, Internet connectivity was also very limited. Limited Internet connectivity in some schools meant that all the computers had Internet connectivity but the Internet could not be accessed at all times. Other schools only had Internet connectivity for a few computers and for a specific use (i.e. administration work). Access to the Internet in the 4 sampled schools therefore, ranged from schools with limited Internet access for learners, to schools with access only for administrator use, and finally, to schools with absolutely no connectivity.

5.4.1 Schools with Limited Internet Access

Although both Macassar Secondary and Marvin Park Primary had Internet connectivity, access to the Internet was limited (MC_F32). For example, only Macassar had full Internet connection for its computers. At this school both teachers and learners could make use of the Internet, however learners could only have access to the Internet after school hours (MC_F33). Even after school hours, learners needed to apply for permission before they could be granted access (*ibid*). During the period of access, a learner was granted only a few minutes, a period of time inadequate to complete an assignment task (*ibid*). Though the school seemed to have full Internet access, time restrictions meant that access was not full and thus limited for learners.

With Marvin Park on the other hand, only the computers in the administration and principal's office have Internet connection (MV_F45). At this school limited Internet access remains a major inconvenience as teachers are not able to perform basic tasks over the Internet. To receive emails teachers have to go via the secretary's or principal's office, which delays the process of sending and receiving emails (MV_K23). A lack of Internet access for teachers means that they are deprived of the efficiencies provided by the Internet (i.e. synchronous and asynchronous communication) which are both useful in enabling teachers to communicate with learners (Mislove *et al.*, 2007).

The surprising finding in this group of schools is that Internet access seems to be more important for administration than it is for teaching and learning (MC_F36), which brings into question the priorities pursued by school authorities. On this point one cannot help to wonder whether it is a question of confused priorities, or doubts about the role of web-based technologies in education. The Internet is supposed to be a resource that enhances the teaching and learning processes (Kinshuk*et et al*., 2003), enabling teachers and learners to connect with one another and with expert support services (Watson & Watson, 2007). Not

only does the Internet provide an efficient means of communication, but it also enables both teachers and learners to access information for research purposes or to gain clarity on a specific topic or concept (Kuhlthau, 2010).

Even though these schools had Internet connectivity for their computers it was not enough and therefore access was only at certain times or for a specific use. Due to the poor economic status of people living in the Macassar area, most learners had no financial means to gain Internet connectivity in their homes. Therefore they relied completely on the Internet access at the school (MC_F39). The Internet usage limitation for learners at Macassar Secondary meant that they where not able to make full use of the Internet facility. They were also not able to benefit from the efficiencies it had to offer for the teaching and learning process (such as providing extra learning resources, enabling teachers and learners to communicate with one another, enabling anytime anyplace learning, enabling teachers and learners to share information etc.) (Caputo, 2000). Unlike their more privileged urban counterparts who had access to Internet in school and at home, the lack of Internet access at Macassar Secondary had a negative impact on the quality of education delivered. A lack of quality education means that these learners will not be well equipped for tertiary education. It also means that learners may not gain the adequate skills that will enable them to be employable.

Similarly at Marvin Park Internet access was limited for both teachers and learners. Teachers in particular, were deprived of the benefits of anytime anywhere access to learning resources as well as synchronous and asynchronous communication that the Internet had to offer. As a result these teachers faced the risk of missing out on important meeting requests or crucial deadlines from the DoE and others, as they could only access the Internet via the secretary's office (MV_K23). For the teachers at Marvin Park Primary this limitation meant that they could not gain extra and relevant information over the Internet to aid the teaching and learning process (MV_K23). For the learners however the situation was worse as they had no form of Internet access at all. This meant that they were completely deprived of the advantages that the Internet has to offer. The lack of access to the Internet at Marvin Park Primary means that the gap between the advantaged and disadvantaged will continue. This can lead to learners gaining a low quality education because of a lack of resources to support the teaching and learning process. The lack of ICT for teaching and learning also means that learners will not be able to partake in the knowledge economy, which is one of the aims of the government's e-Education policy. Government's inability to achieve its e-Education policy goals means that its affected citizens will not be ICT competent. Therefore in order to completely benefit from the efficiencies of the Internet both teachers and learners should be given full Internet access.

At Macassar Secondary, the reason, according the school policy, for limiting Internet access, is in order to limit misuse by pupils (MC_F33). Apart from the library, where there are only two computers the school is the only place where learners can access the Internet (MC_F39). When considering the relevant infrastructure, although Macassar has Internet, access is not full, as it is limited for the learners (MC_F33). With the lack of Internet connectivity outside of school it would be expected that learners at Macassar would be given full access to the Internet, however this is not the case. Hence these learners are not able to experience the full benefits of the Internet for the teaching and learning process (which includes up to date information at anytime and in anyplace) (Koc, 2005; O'Lawrence, 2007), robbing them of resources needed to improve their quality of education. At Marvin Park, budgetary constraints were also cited as the main cause of the limited availability of Internet access (MV_F45).

Whilst teachers and learners do need Internet access, they are helpless to improve their situation while they hindered by the circumstances of their environment. This problem is even worse in schools where there is no Internet connectivity at all, as discussed in the section 5.4.2 below.

5.4.2 Schools with no Internet access

As if the limitation of Internet was not inhibiting enough to educational processes, two additional schools; Sithembele Matiso Secondary (SM_D27) and Kulani Secondary (KH_B38) according to the findings in Table 7, did not have any form of Internet connectivity. As a result, some of the teachers in this school had to travel to the nearest schools with connectivity, to access the Internet (SM_D27). In this unfortunate situation, both teachers and learners are deprived of the benefits of teaching and learning that are associated with the use of the Internet (i.e. fast information distribution, anytime anywhere access, communication medium, administrative assistance, accommodation of various levels of learning, increased learners understanding, distribution of learning materials and etc.). Being unable to access crucial teaching and learning resources, teachers in disadvantaged schools are not able to provide education that is of quality. Learners are also robbed of the benefits of the Internet, including up to date information and even general guidelines provided on the Internet, which can be a requirement for the completion of assignments.

A lack of Internet connectivity at the schools, inadequate technical support, lack of finance and poor coordination were cited as barriers to access to a fully functioning Internet at both Sithembele Matiso and Kulani Secondary. With regards to technical support, teachers and learners at Sithembele Matiso were at times forced to go for long periods without Internet due to delays in providing technical support by the Khanya Project (SM_D27). Not only were teachers and learners at Sithembele Matiso faced with the issue of lack of technical support, but the school had to use its limited income to financially provide for the support and

acquisition of their ICT facilities due to that inadequate support. For example support from the Khanya Project was limited to only 5 years. This posed a huge problem, as the school suffered from a lack of financial resources for acquiring ICT facilities (SM_D30). At Kulani Secondary neither the ICT coordinators nor other educators knew the reasons for the lack of Internet connectivity at the school (KH_B38; KH_M27). This is very surprising. It would be expected that at least the ICT coordinator would know the causes of the lack of Internet connectivity. Since this was not the case, one wonders if the ICT facilities at this school were competently coordinated.

According the framework (Figure 2), the inability of e-School coordinators to achieve their goal of physical deployment of ICT into schools means that learners in affected areas will miss the basic foundations that will equip them for the future. They may fail to become productive and innovative citizens that take an active role in the economy (Nonyane, 2011).

With the disappointing progress being made towards the government's goal of physical deployment of ICT facilities into schools, the findings show that the goal of integration of ICT into school curricula is also far from favourable. As a result, very few subjects are facilitated with computers. This is discussed in detail in section 5.5 below.

5.5 Integration of computers into school curricula

Findings in Table 7 indicate that very few courses/subjects within the 4 sampled schools were facilitated with computers.

In these schools, only 3 out of 9 subjects in Marvin Park (MV_F59; MV_F62) and 3 out of 12 subjects in Macassar Secondary (MC_F20; MC_F21) had a computer facilitated aspect. Sithembele Matiso being worse off had 2 out of the 12 subjects (SM_D35; SM_D40) whilst Kulani Secondary had only 1 out of 13 subjects (KH_B5; KH_B51) that had a computer facilitated aspect. According to Moraru *et al*., (2011) the use of educational software within the classroom enhances the teaching and learning environments. It makes complex subjects such as science and maths, easier to understand (*ibid*). Furthermore ICT also speeds up the learning process through its instant and interactive feedback functionalities. On this point, participating teachers viewed ICT as a significant enhancer of the teaching and learning process (KH_B7; KH_M6; MC_F5; MV_F9; SM_D5), saying it simplifies difficult concepts, making learning easier and fun (KH_B7; KH_M7; MC_F6; MV_K6).

Looking at the benefits of these educational programs in enhancing the quality of education, and stated commitment, in terms of the e-Education policy, one would expect a full integration of ICT with curricula, especially in disadvantaged schools where there is a lack of teaching and other resources. Sadly, this is not the case in the 4 sampled schools. One of the justifications for a limited integration, according to the Khanya Project, (one of the government projects responsible for placing computers into South African schools), is that

the software placed in schools is aimed specifically to cater for subjects such as maths and science (The Khanya Project, 2010). This statement gives an impression that the exclusion of computer facilitated programs in other subjects may be a deliberate government policy. Thus, it did not come as a surprise to find that maths (KH_B49; SM_D35; MC_F20; MV_F62) and science (SM_D35; MV_F62) were the only computer facilitated subjects, leaving the majority of subjects without computer facilitated components in all 4 schools. The exceptions to this statistic were Macassar Secondary, with computer applications technology and life orientation (MC_F20), and Marvin Park primary school with languages, in their lists of computer-facilitated subjects (MV_F62). Contrary to the Khanya project's apparent bias towards maths and science however, the National e-Education policy advocates a full integration of ICT into the overall curricula in schools across South Africa (DoE, 2003).

The contrast between policy and the practical aspects of its implementation brings into question whether the objectives are clear or known. The e-Education policy is an enabling vision for the deployment of educational ICT in schools. Unless competently coordinated (implementation) however, the vision alone can not yield visible outcomes. With the government aiming to integrate ICT into school curricula, the small number of subjects facilitated with computers at present, indicates an imbalance with regards to achieving curriculum equilibrium (i.e. a computer facilitated aspect for all subjects). This imbalance means that learners are not able to gain the full benefits of ICT in education. For example, they will miss benefits such as the simplification of difficult concepts and the acceleration of the learning process (Moraru *et al*., 2011). Given the legacy of apartheid and national undertakings towards equitable development for all, this imbalance indicates a continued gap in terms of resources between the wealthy few and the underprivileged masses.

Computer resources and their integration into curricula, unfortunately, have not been the only factor working against the quality of learning in these under-resourced schools. In effect, there are instances where minimum facilities within these schools exist, but could not be put into maximum use because educators lack the basic skills necessary to integrate ICT into curricula. In terms of the findings, the status of computer literacy and skills amongst educators is presented in Table 8 under section 5.6 in pages that follow.

5.6 ICT Skills amongst Educators

Drawing on the e-Schools Activity theory analytical framework in Figure 2, the goal of the fourth actor, the educators, is to become effective teachers that are competent in using educational tools (i.e. ICT, educational software and the Internet etc.) to enhance the quality of learning in schools. Consequently the goal of the first actor, the DoE, is to improve ICT literacy for educators.

Starting with teachers as actors, the achievement of their goal (teaching effectively and competency with educational tools usage), depends on interaction between activities, the mediating factors and the transformation process. One of the mediating factors is the national coordination of the program (Integration of ICT into schools' curricula). The most important drive however is the ability and skill of teachers to use ICT. They are required to competently use teaching as well as learning facilities, to deliver quality instruction and support quality learning.

Findings in Table 8 indicate that very few teachers were using subject specific educational software.

Table 8: Status of ICT Skills amongst Educators

Name of schools	# of Teachers	Teacher ICT Skill/Training offered?	Training provider	Adequacy of training	Teachers teaching with computers	Explanation
Kulani Secondary	+- 29 (KH_B45)	Yes (KH_B9)	DoE (KH_B10)	Only basic computer literacy and how to use the learning programs (i.e. maths) (KH_M19). Not specialised to master other teaching programs, & therefore not adequate (KH_B13; KH_M20)	+-7 maths teachers (KH_B46; KH_M54)	• In explaining why other subjects were not taught with computers, teachers did not know (KH_B49). • In explaining why computer training was not specialized to master other teaching programs according to the educator the authorities give basic computer literacy training because they believe the learning programs are easy and straight forward to use and therefore do not require further training to master them (KH_M10; KH_M20; KH_M53).
Macassar Secondary	+- 21 (MC_F27)	Yes (MC_F11)	Khanya Project (MC_F11)	General computer usage, Word processing, administrative skills & Internet usage with training in the usage of subject specific computer programs for only geography teachers. Not specialised to master other teaching programs, & therefore not adequate (MC_F11; MC_F24)	Maths, computer application subjects, life orientation, sometimes languages & geography teachers (MC_F22, MC_F24; MC_F44)	• In explaining why other subjects were not taught with computers, an educator mentioned that there are not enough skilled teachers to teach the other subjects (MC_F23). • In explaining why computer training is not specialized to master teaching programs, an educator mentioned that one of the tasks of the educational authorities is to train teachers on the basic use of computer therefore not all the subjects receive training (MC_F11; MC_F24).
Sithembele Matiso Secondary	+- 38 (SM_D46)	Yes (SM_D11)	Khanya Project (SM_D11)	Basic Computer literacy, ability to type question paper. Not specialised to master teaching programs, & therefore not adequate (SM_D14)	Maths and science teachers (SM_D49)	• In explaining why other subjects were not taught with computers, an educator mentioned that according to the Khanya Project first preference goes to maths and science subjects (SM_D6;SM_D37). • In explaining why computer training is not specialized to master teaching programs an educator mentioned that they are not trained to teach but they are trained for their own benefits e.g. typing personal documents or exam papers (SM_D15).
Marvin Park Primary	+- 31 (MV_F52)	Yes (MV_K12)	WCED/DoE (MV_K12; MV_F15)	Software usage, e-teacher, learning areas e.g. maths and languages. It is adequate (ICT Coordinator: MV_F18) Basic computer literacy. Not specialised to master teaching programs, & therefore not adequate (educator: MV_K12)	Maths, English and Science teachers (MV_F62)	• In explaining why other subjects were not taught with computers, an educator mentioned that the main focus of the DoE is to integrate computers into subjects that lack skilled teachers such as Maths, English and Science (MV_F62). • In explaining why computer training is not specialized to master teaching programs an educator mentioned that the facilitators from the department were where not well equipped and therefore unsure of how to conduct the training courses (MV_K12; MV_K14).

As has been mentioned, very few subjects in these four schools were taught using subject specific learning programs (MC_F22; MC_F24; MC_F44). In Macassar Secondary, 3 subjects out of 12, maths, computer application and life orientation (MC_F20; MC_F21). In Marvin Park, 3 subject out of 9 English, maths and science (MV_F59; MV_F62). In Sithembele Matiso, 2 subjects out of 12, maths and science (SM_D35; SM_D40), and in Kulani Secondary, one out of 13 subjects maths (KH_B5; KH_B51). In addition to a lack of educational software for the rest of the subjects, a lack of relevant skill and access to training opportunities among the majority of teachers is also a strong limiting factor. With regards to training, most educators within the sampled schools, were only given basic computer literacy training (KH_B13; MC_F11; SM_D14; MV_F18), which is inadequate in ensuring competency with educational software. However there was an exception. At Marvin Park Primary, one teacher was provided with training on Software usage and its integration into school curricula as well as on being an e-teacher (MV_K12). According to Molope (2006), it is difficult to master the knowledge and usage of technology. Therefore broad formal training in conjunction with practical experience is key in ensuring successful integration of technology into school curricula (*ibid*). By providing ICT skills training for teachers, the South African government shows that it recognizes the importance of teacher advancement and empowerment. It is sad however that out of the 8 participants interviewed, only one of the teachers had a fairly extensive training in software usage and its integration into school curricula. The rest only had basic computer literacy training which was not designed to empower them to master educational programs (KH_B13; MC_F11; SM_D14; MV_F18). Inadequate training means that teachers are provided with instructions about software, but left with insufficient skill to use it. This can lead to poor application of the technology and therefore affect the quality of education given to their learners. With the disadvantaged background of these learners, an education ought to provide them with opportunities to advance themselves and in turn improve their standard of living. However in comparison to the privileged few, the poor quality education received by the learners in these schools, indicates a continued gap between the haves and have nots. This situation will affect the performance of these learners at post-matric levels and also their chances of being employable. With the government wanting to ensure the correct integration of computers into school curricula, lack of specialized training means that teachers are not well equipped to teach complex subjects with computers, leading to a poor implementation of computers into school curricula and ultimately, negatively affecting the e-Education goal of integrating ICT into schools curricula. The effects of this can lead to failure in the implementation of this e-Education policy goal.

Looking at the explanations as to why few subjects were taught using subject specific educational software, various reasons were cited. Participants at Sithembele and Marvin Park stated that according to the DoE and the Khanya Project, preference goes to providing

training for subjects with the least skilled teachers (SM_D6; SM_D37; MV_F62). These subjects are English, Science and Maths (*ibid*). At Macassar on the other hand, participants expressed the opinion that, there were not enough skilled teachers to teach the other subjects using educational software (MC_F23). At Kulani reasons for only a few subjects being taught using subject specific educational software were unclear or unknown (KH_B49).

On the subject of why training was not specialized in order to master other teaching programs in the 4 schools, these were the responses according to the teachers (KH_M10; KH_M20; KH_M53; MC_F11; MC_F24) the educational authorities provided only basic computer literacy training. The reason for only providing basic computer literacy training was that the authorities believed that the learning programs were easy to use and therefore the teachers would not require further training to master them. Another educator mentioned that in consequence, teachers were not trained to teach using ICT, but they were provided with training on associated skills (i.e. typing skills) that would benefit them personally. One educator said that the facilitators from the DoE were not well equipped, and were therefore unsure of how to conduct training courses (MV_K12; MV_K14). This response raises the question; was training focused only on basic computer literacy, because the DoE lacked resources or skills to provide more specialized training?

With it being so important for educators to be familiar with the correct application of technology for improving the quality of education, measures such as providing more specialized training, need to be taken, to enhance ICT skills amongst educators. Such training could help transform the goal of providing ICT skills to educators into positive educational outcomes. For example the goal of the educators is to become effective teachers with competency in using educational tools. Thus it is necessary for the goal of the DoE to be to improve ICT literacy skills (Figure 2). Activities required by the educators include the competent use of teaching as well as learning facilities, to deliver quality instruction and support quality learning. Although this goal is vital in improving the quality of education, without enough support to achieve this goal it will never to become a reality. With the above evidence on the discrepancies revealed in the deployment of ICT into schools and its integration into school curricula, the aim of the study as well as the findings are further discussed in section 5.7 below.

5.7 Discussion of Findings

In this thesis the opening discussion is that new technology-based innovations have changed and globalized the world economies, with a transformative influence on the quality of modern life. Since the development and use of technology in these new innovations requires access to information and specialized knowledge, the quality of and equity in education is vital, with ICT being an enabler (DoE, 2003). To this effect the South African government has developed an e-Education policy to ensure that every learner has the ability to competently and creatively make use of ICT. A lack of ICT for teaching as well as learning and a lack of skilled teachers to integrate ICT fully into school curricula can be obstacles that prevent the realisation of the e-Education policy goal. This can lead to learners receiving a sub-marginal education, hindering their progress in tertiary education and further preventing them from acquiring the right skills they need to become employable. A lack of skilled individuals within a country can have a negative impact on its economy and prevent its citizens from crossing over to the era of the knowledge economy (United Nations Environment Program, 2010).

Outlined in the framework (Figure 2) are the goals of the 4 stakeholders in the study. The goals of the DoE are to ensure equitable access to education of quality, to integrate ICT into school curricula and to improve ICT literacy amongst educators. Secondly, the training colleges and schools seek to produce educators that are competent in all aspects of curriculum delivery. Thirdly, the e-School coordinators seek to ensure the deployment of appropriate ICT into all schools. Fourthly, the educators seek to become effective teachers who are competent in using educational tools such as ICT to enhance the teaching and learning process.

Inability of any of these stakeholders to achieve their goals means that learners will not be able to fully benefit from the efficiencies of ICT. This in turn, robs them of equal access to quality education as advocated by the government's e-Education policy. A lack of quality education means continued poverty and marginalisation amongst citizens, with a negative impact on the economy and the country's developmental efforts. A discussion of findings on the status of ICT deployment, ICT skills for educators and integration of ICT into curricula, is provided in sections 5.7.1, 5.7.2 and 5.7.3 below.

5.7.1 Discussion on the Status ICT Deployment

Findings show a disturbing situation. There is a lack of adequate ICT resources for teaching and learning in the 4 sampled schools. In explaining the reasons, most educators cited a lack of finances as the main causal factor. They can only rely on projects such as Khanya to provide computers (KH_B32). Only Macassar Secondary had the financial means to purchase and maintain their ICT resources. The funds allocated for ICT resources at this school were however limited (MC_F29). With the government's goal of physical deployment

of ICT and its integration into school curricula, a significant enabler towards the achievement of this goal is financial support. Ideally governments should ensure that there are adequate funds available for educational authorities and other organizations to implement this goal. However, the findings indicate a lack of finance as a great inhibiter of the deployment of ICT into schools. This lack of funding brings into question the commitment of the government to its efforts to deploy ICT into schools. One educator indicated that they were unsure or unclear of the reasons for the high learner computer ratios. Coupled with high numbers of learners per computer, access to the Internet in the 4 sampled schools ranged from, limited Internet access for teachers and learners to no form of Internet connectivity at all. According to the educators, the reasons for the insufficient Internet access were, primarily a lack of or limited availability of financial resources (MC_F29; MV_F45) and secondly a lack of technical support that resulted in servers not working over a long period of time (SM_D27). Worst of all, one ICT coordinator did not even know the causal factors of the unavailability of Internet connectivity at the school (KH_B38). Lack of awareness of the problems affecting the successful running of the ICT facilities means that although an ICT coordinator had been appointed competency was not apparent.

Over 18 years into democracy, South Africa is still dealing with the legacy of apartheid in its education system. The country still faces developmental discrepancies which maintain the gap between a majority that is largely disadvantaged and the privileged few. To redress these developmental issues, quality education is seen as key, with ICT seen as an enabler. ICT can ensure access to quality of education, which in turn, decreases marginalization and reduces poverty so as to improve the standard of living amongst citizens (DoE, 2003). Hence in developed countries educational technologies form a great part of the teaching and learning process. They create new learning and teaching possibilities, improve achievements and widen the interaction with local and global communities (infoDev, 2010). This has effectively enabled learners to be involved in the current information explosion and has further transformed society and economic structures within developed countries (*ibid*).

In South Africa learners in disadvantaged communities suffer from resources inequalities, affecting the quality of education provided. Studies by Mlitwa & Nonyane (2008), Mlitwa (2010) and Nonyane (2011) indicate that there are not enough individuals with ICT skills in South Africa to contribute to the economic development and the lack of quality education is a contributing factor. For example in the 2011 only 52% of matric candidates qualified for admission to higher education (PMG, 2012). Even when learners did qualify for tertiary education one wonders as to whether they were sufficiently well equipped for the tertiary level of study (Macgregor, 2010). The inability of learners to handle the demanding requirements of higher levels of education results in many failing or discontinuing from their studies (*ibid*). In addition to this, other factors (i.e. lack of financial support) prevent students from continuing with their tertiary education. Therefore the drop out rate in tertiary institutions

is very high (*ibid*). This means that learners are not well equipped or are not adequately supported financially for the tertiary level. Such a situation can also affect their chances of being employable, with minimal chance to improve their quality of life. Thus it can be seen that a realization of the e-Education policy goal of physical deployment needs to make significant progress so as to improve the quality of education. However the findings indicate that this is not the case. Schools in the Western Cape still suffer from resource inequalities. Although efforts have being made to redress this issue, the inability of learners to gain full access to ICT resources (i.e. computers and Internet etc.), means that they cannot fully benefit from its efficiencies (i.e. synchronous and asynchronous communication, anytime anywhere access to up-to-date information and data capturing etc.). The current situation, regrettably, reduces the potential of the system to improve the quality of education delivered (Diouf & Ngamo, 2010).

Inability of the stakeholders to achieve their goal means that learners will continue to receive a sub-marginal education which can have a detrimental effect on their progress in tertiary education and further, on their chances of being employable. Learners from these disadvantaged schools are least likely to have the necessary ICT skills. Furthermore a lack of skilled individuals within a country can ultimately have a negative impact on its economic development.

5.7.2 Discussion on the Status of ICT Integration into School curricula

The findings (Table 7) indicate a disappointing status, that is, very few subjects have a computer facilitated aspect. While maths and science subjects have a computer facilitated aspect, other subjects are left outside of the ICT integration equilibrium. Thus, learners are not able to benefit from ICT that has the potential to transform the teaching and learning process, making it simple, interactive as well as efficient. This is in contrast to other parts of the world, where full ICT curriculum integration is seen as crucial in improving the quality of the curriculum delivered. The importance of full curriculum integration is recognized in countries such as Singapore and Thailand whereby learners enjoy full ICT integration into school curricula (UNESCO, 2004). In Singapore for example, learners are required to gain specific ICT skills from as early as primary school (*ibid*). Furthermore ICT is integrated in different subject areas to ensure the readiness of learners to partake in the digital economy.

In the 4 sampled schools however, a lack of; educational software and financial resources were cited as reasons for the poor status of ICT integration into the curriculum (KH_B49; MC_F29; SM_D53; MV_F21). With the learners at these schools already facing difficulties in attaining a good quality of education due to their disadvantaged status, the failure of the DoE's goal of ICT integration into school curricula, means a continued gap between the privileged few and the underprivileged majority. Furthermore these learners will carry on gaining a sub-standard education, which can have a detrimental effect on their progress in

tertiary education and on acquiring the relevant skills to be employable. With the importance of skilled individuals for advancing a country's economy (OECD, 1996), the lack of skilled workers in South Africa can have a negative impact on its economy.

5.7.3 Discussion on the Status of ICT Skills amongst Educators

The framework in chapter 4 (Figure 2) indicates that the goal of educators is to become effective and competent teachers and the goal of the DoE is to improve ICT literacy amongst educators. According to the findings (Table 8) however, the status of ICT skills amongst educators was unsatisfactory. The number of computer facilitated subjects was limited to maths and science in most schools (KH_B5; SM_D9; MV_62). This meant that both teachers and learners were deprived of the benefits of ICT for teaching and learning (i.e. simplification of difficult concepts and multimedia learning etc.). Reasons for this poor status of ICT skills according to educators were a lack of ICT resources and inadequate ICT skills amongst educators. In terms of ICT skills training teachers were only given basic computer literacy training (MC_F23; MC_F11; MC_24). The reason for this was that educational authorities believed that the learning programs were easy and straight forward to use and therefore did not require specialised training to master (KH_M10; KH_M20; KH_M53). The practical aspect of this however meant that teachers were not well equipped to teach complex subjects using educational software. As a result some teachers lost the motivation to teach using subject specific software (MC_F1; MV_K14; MV_K17). Furthermore according to Hepp *et al*., (2004) the chances of educators integrating ICT into their teaching processes is greater if they have specialised training in the use of ICT and are provided with the time to practice using the technology and to study, share and work together with colleagues.

A lack of skilled teachers means that learners will continue to receive a poor quality education. With education being key to the success not only of an individual but of a country, a poor quality education means that these learners are not well equipped to succeed at a tertiary level of education nor to access better career opportunities in the job market.

5.8 Conclusion

The chapter presented the research findings. This was followed by a discussion of these findings. The study sought to investigate various situations in the education system in order to discover why there are discrepancies in the successful deployment of ICT into schools and its integration into curricula. With regards to the physical deployment of ICT into schools the findings indicate that the ratio of learner per computer in the 4 sampled schools did not meet the ideal standard nor the one set by developed countries. Findings on the integration of ICT into school curricula indicate that very few subjects had computer facilitated aspects. The findings on ICT skills amongst teachers indicate that most teachers had only received basic computer literacy training and were therefore not given specialized training on teaching,

using educational programs. Furthermore very few teachers were teaching using computers. Clearly, the findings show that the status of ICT deployment into schools and its integration into school curricula is far from favourable. Finally a conclusion of the thesis, together with recommendations is offered in detail in the following chapter, Chapter 6.

CHAPTER SIX: CONCLUSION AND RECOMMENDATIONS

6.1. Introduction

This chapter opens with a summary of the findings on ICT deployment and its integration into school curricula (section 6.2). This is followed by a conclusion of the thesis in the section 6.3 and a set of recommendations in the section 6.4, as well as suggestions for future research in the section 6.5.

6.2. Summary of Research Findings

The objective of this study was to understand the poor status of ICT deployment into schools and its integration into school curricula, together with the causal factors so as to inform remedial efforts. To aid this investigation 8 participants from 4 sampled schools were interviewed. A summary of and explanations to the findings are presented in Table 9 overleaf.

Table 9: Summary of Findings & Explanations as to the poor Status of ICT Deployment & its Integration into School Curricula

Name of schools	Status of:				
	ICT Deployment (1)	**ICT integration (2)**	**ICT Teacher Skills (3)**	**Causes**	**Explanation**
Kulani Secondary	• High learner per computer ratio • No Internet connectivity	• Few computer facilitated subjects	• Basic ICT literacy training • Few teachers teaching with computers	• Lack of funds (1) • Unknown (1) • Unknown (2) • Only basic training was provided (3)	• Computers were donated by Khanya Project (1) • The school relied on projects such as Khanya to provide computers (1,2) • Unknown (1) • Unknown (2) • Educational authorities believed the learning programs were easy and straight forward to use and therefore did not require further training to master them (3)
Macassar Secondary	• High learner per computer ratio • Limited Internet access for learners	• Few computer facilitated subjects	• Basic ICT literacy training • Few teachers teaching with computers	• Lack of funds (1) • Lack of skilled teachers (2) • Only basic training is provided (3)	• The school had some financial means to acquire and maintain ICT resources however it was limited (1,2) • The school suffers from a lack of staff especially once who are specialized in teaching using ICT (2) • One of the tasks of the educational authorities was to train teachers on the basic use of computers therefore teachers were not trained to teach using subject-specific software (3)
Sithembele Matiso Secondary	• Very high learner per computer ratio • No Internet connectivity	• Few computer facilitated subjects	• Basic ICT literacy training • Few teachers teaching with computers	• Lack of funds (1) • Server not working (1) • Not enough computers (2) • Only maths and science subjects have a computer facilitated aspect (2,3) • Educators were trained for their own benefits (3)	• The school is waiting for the technicians from the Khanya Project to fix the Internet (1) • The school relied on the Khanya Project to donate computers (1, 2) • There was not enough financial resources to purchase computers (1, 2) • According to the Khanya Project first preference goes to maths and science subjects (2, 3) • Educators were not trained to teach but they were trained for their own benefits (3)
Marvin Park Primary	• Very high learner per computer ratio • Limited Internet access for teacher and learners	• Few computer facilitated subjects	• Basic ICT literacy training (educators) • Specialized ICT training (ICT coordinator) • Few teachers teaching with computers	• Lack of funds (1, 2) • Focus was on math science and English subject (2) • Educators were not adequately trained (3)	• Computers were donated by the Khanya Project (1) • The school is disadvantaged therefore it lacks funds (1) • The school couldn't afford additional computers or learning programs (2) • Main focus of the DoE was to integrate computers into subjects that lack skilled teachers such as Maths, English and Science (2, 3) • Facilitators from the department were not well equipped and therefore unsure of how to conduct the training courses (3)

Findings in Table 9 indicate that the status of ICT deployment into schools and its integration into school curricula is far from ideal. The status was very disappointing, in that the ratio of learners per computer was too high and therefore impractical. That is, whilst one needs a computer to access information and to perform individual tasks, the learner to computer ratio did not meet the ideal standard of 1 to 1 nor the one set by developed countries of 5 to 1 (U.S.A. DoE, 2000; OLPC, 2005). A lack of computers means that both teachers and learners will not fully benefit from the efficiencies that ICT has to offer (i.e. aids presentations, simplifies difficult concepts, aids experiments and helps to capture data etc). Hence learners at these schools will continue to gain a sub marginal education, which can have a negative impact on their successful completion of tertiary education and further hinder their chances of being employed. Reasons for the poor status of ICT deployment into schools, according to educators, were a lack of financial and technical support (MC_F29; KH_B32; MC_F48; MC_P14). Poor coordination of ICT resources was also cited as a factor working against the successful deployment of ICT into schools. One ICT coordinator was unable to suggest any reasons why there was for no Internet connectivity at the school (KH_B38; KH_M27). Looking at the goals of physical deployment, if the educational authorities were serious about carrying them out then the status of ICT deployment would be far better. Rather the current status of ICT deployment into schools is far from ideal, it brings into question the will of the authorities to achieve the goal of universal access to ICT.

The status of ICT integration into schools curricula is also poor, in that very few subjects had a computer facilitated aspect. In most schools for example, only maths and science were taught using computers (KH_B49; SM_D35; MC_F20; MV_F62; SM_D35; MV_F62). It was only on rare occasions that other subjects (i.e. languages, computer applications technology, geography etc.) were taught using an educational computer program (MC_F20; MV_F62). The ICT component in these subjects was limited and none of the schools had full ICT curriculum integration. Once again learners were deprived of the full benefits of ICT in improving the quality of education delivered (i.e. helps to simplify difficult concepts and aids with experiments etc.). Lack of quality education can have a negative impact on a country's economy, as it can lead to poorly skilled individuals and leave a gap in the pool of skills required for the country's development. Causes for the poor status of ICT integration, according to educators, were a lack of skilled individuals to teach using subject specific learning programs, a lack of computers and a lack of financial resources (MC_F23; SM_1D; MV_F21; MV_F45).

Looking at the goals of the educational authorities to integrate ICT into the full school curriculum, it is puzzling as to why there is such a poor status of ICT integration into school curricula. This brings into question the methods used to achieve this goal and whether the goal will be achieved by its deadline in the year 2013.

Similarly the status of ICT skills amongst educators was unsatisfactory as educators only had basic computer literacy skills (KH_M53; MC_F11; MC_F24). Educators were only given basic computer literacy training, because the educational authorities believed that the learning programs were easy and therefore the educators did not require further training (KH_M10; KH_M20). As a result some teachers lacked the specialized skills needed to be able to teach using educational software (MC_F23). Another factor that contributed to the poor status of ICT skills among educators was that ICT trainers were not well equipped for the training sessions (MV_K12; MV_K14); hence they could not give the educators good quality training on how to integrate ICT into curricula. Regrettably, the findings paint a very poor picture, in terms of the achievement of the goals of the DoE, not only to improve ICT literacy but also to enable educators to become effective teachers that are competent in using educational tools. However, with the trainers being ill equipped for the training sessions it is not surprising that the educators lack the skills, and thus the motivation to teach using ICT such as educational software, computers, Internet etc. The difficulties revealed in this study, in the achievement of the goal of ICT literacy amongst educators brings into question the potency of government's efforts to achieve this goal.

6.3. Conclusion

This thesis sort to investigate the status of ICT deployment into schools and its integration into school curricula. In terms of ICT deployment, the findings reveal a bleak picture in terms of the student to computer ratio in schools. The ratio of learners per computer did not meet the ideal standard of 1 learner per computer nor the one set by developed countries of 5 learners per computer. At the first instance, a disappointing student-to-computer density is an access and digital divide issue misfortune for affected schools. The reality is that whilst "teachers need tools to make their life easier and that when they use those [ICT] tools" Miller, (2012), the environment continue to let them down. According to the real access criteria of Bridges.org (2005), it is not helpful to have computers that are not usable, either because they are not functioning or the numbers are inadequate. Awareness about ICT and related benefits by local (i.e. school) authorities, which is clearly lacking among educators in sampled schools is also significant, in that users are the ones who should select tools they need (Miller, 2012). Even "the software needs to be well selected", and "there must be collegial support, technical support and leadership from the principal" (*ibid*.). The question thus remains whether the policy pronouncement were just "all-talk and no action?" Understanding the causes of the status quo becomes critical in this respect. Arguments are that the e-Schooling drive has always been disjointed at the national implementation level, with progress in few provinces depending on isolated innovative efforts of some "Holy Samaritans" (Anushag, 2012). Drawing on the activity theory framework in Figure 2, causes can be linked to a breakdown in information flows between the DoE, the provincial e-Schools

coordinators and the stakeholders in affected schools. The framework also point to a discrepancy between the goals of all stakeholders and the mediating factors such as the selection of competent coordinators, budget allocation issues, communication between all stakeholders, clear implementation guidelines as well as oversight and control on acquisition and delivery of hardware and software into all school. Finally, basic enabling infrastructure such as electricity, secured classrooms and skilled educators are also critical. Discrepancies in these respects explain the status quo in sampled schools.

With regards to ICT integration into school curricula the findings indicate that very few subjects had a computer facilitated aspect. With teacher ICT skills, the findings show that most teachers were only given basic computer literacy training and not trained on how to teach using subject specific educational software. Consequently very few teachers were teaching using subject specific educational software. Most commentators in the literature are quick in blaming teachers as technophobic and resistant to change. Teachers are accused of wanting "to maintain the status quo. They do not wish to change what they have been used to, [and the] question they often ask is if it has been working for me all along, why I should change?" (Gacicio, 2012). With findings in this study pointing to all stakeholders in the activity system as being uncommitted, with disjointed implementation efforts however, it is hard to locate the blame purely on teachers. The activity theory once again, point to a similar discrepancy between the mediating factors and respective activities in the e-Schools activity system.

Considering the findings on ICT deployment into schools and its integration into curricula this thesis can conclude that the goal of the e-Education policy to ensure; universal access to ICT, full integration of ICT into school curricula, that teachers are competent and able to teach using ICT, has not been achieved. It is evident that there are various factors inhibiting the deployment of ICT into schools and its integration into curricula in disadvantaged communities. If these inhibiting factors are not addressed, learners in these schools will continue to be deprived of the opportunities to gain good quality education. This can hinder their progress in life and their future contributions to the country's economy. To redress the ICT resource inequalities amongst disadvantaged schools in comparison to their counter parts in more affluent areas a set of recommendations are offered in the section 6.4 below.

6.4. Recommendations

Through the e-Education policy the South African government seeks to ensure the deployment of ICT into schools and its integration into school curricula. The achievement of this goal should result in teachers and learners gaining full access to the benefits of ICT for teaching and learning (i.e. making learning easy and fun, enabling access to extra learning resources, enabling learners to learn from anywhere and at anytime and making

collaborative learning possible etc.). To achieve the goals of universal access to ICT, best practices across Asia and the Pacific Region include; linking policy development with government initiatives, such as the donation of computers and the provision of free Internet access (UNESCO, 2004). The government ministries are also encouraged to make use of their expert knowledge and experience to help coordinate the implementation of ICT into education (*ibid*). Furthermore governmental ministries and agencies are motivated to promote initiatives that involve participation from the private sector (*ibid*).

Within the South African context, according to the e-Education policy goal of physical deployment of ICT into schools, ideally all learners should be able to perform individual tasks using their own computer with adequate educational software and skilled educators. However, findings (Table 7) indicate a disappointing status, with a lack of ICT resources (i.e. computers and the Internet) in the 4 sampled schools. The reasons for the poor status of ICT deployment into schools, according to educators, were a lack of financial resources and poor ICT coordination and technical support (SM_D53; MV_F45; MC_F29). According to the activity theory analytical framework (Figure 2), the goals of the e-Schools coordinators (i.e. physical deployment) can be achieved when mediating factors along with tools are supported by their respective activities to transform goals into positive outcomes. A mediating factor that can help achieve the goal of physical deployment is financial resources. With a policy already in place to promote the deployment of ICT into schools, it would be expected that supporting factors such as financial resources would be available for this purpose. However this is not the case in the sampled schools, according to the findings. Financial issues affecting the 4 sampled schools appears to be a result of the priorities set by the school authorities when it comes to fund allocation, with the deployment of ICT into these schools appearing to have a very low priority. Given the clear policy undertakings, however, this can be attributed more to poor coordination of financial resources than to a lack of political will. It is clear, on this basis that the current model of financing the deployment of ICT resources into schools is not working properly. In Kenya an investment program was proposed to provide school improvement grants (MOEST, 2005). The aim of this investment strategy was to provide financial support for schools, improve infrastructure as well as monitor and evaluate progress and impact (*ibid*). A recommendation in this thesis therefore, is that authorities should revise the efforts made to deploy ICT into schools and possibly appoint personnel to audit the process, including the funding model. This can be achieved by appointing personnel to keep record of the funding process. In instances whereby schools do not have sufficient financial resources to achieve their goals of ICT deployment, authorities can refer to the audits and confirm whether money has been allocated and if it has been received by the schools. This will ensure that there is an account of where funds are allocated and what they are being used for. However, the problem in the 4 sampled schools is larger than just financial limitations.

There is also a clear lack of common understanding between school communities and policy makers, with teachers and ICT coordinators not knowing the ICT deployment details for their schools. As a recommendation, this thesis draws on the Work Activity Framework in Figure 2 to recommend a revised communication process between the national, provincial and local (school) coordinators on the full details of ICT deployment in schools. In other words, school principals and coordinators must be aware, and be clear about the numbers of computers, maintenance needs and procedures as well as specific software and connectivity details required in their schools. This can be achieved through regular audits on the ICT resources available in the schools. Results of the audits should be communicated via the right channels to relevant government departments, with departments also playing an active role in monitoring progress towards this goal.

Other mediating factors are supporting technical and social environments. In this instance a supporting technical environment refers to the availability of infrastructure such as classrooms or labs and telephones and electricity to support the deployment of ICT. A supporting social environment in this context is the wiliness of teachers and learners to learn about and make use of ICT for teaching and learning processes. These mediating factors can be supplemented with tools such as relevant ICT (i.e. computers, Internet, educational software, printers, scanners and copiers etc.). Additionally the framework (Figure 2) indicates that the e-Schools coordinators are required to carry out activities such as liaising with schools to ensure the goals of ICT deployment are transformed into positive outcomes.

Similarly, when considering the DoE's goal of ICT integration into school curricula, the ideal situation would involve all school subjects having a computer facilitated aspect. Although efforts have been made to ensure the integration of ICT into school curricula, findings show that very few subjects within the 4 sampled schools had a computer facilitated aspect. The causal factors for the poor status of ICT integration according to the educators were; a lack of educational software and relevant ICT (KH_B49; MC_F29; SM_D53; MV_F21). Furthermore the organisations involved in deploying ICT into schools mainly focused on integrating ICT into specific subject and not into the full curricula (The Khanya Project, 2010). In this regard there seems to be a misunderstanding of the requirements for the achievement of the goal of ICT integration into school curricula. With priorities for ICT integration being given to maths and science subjects (KH_B5; SM_D9; MV_62), teachers and learners are deprived of the benefits of using ICT for the other subjects.

To redress this situation here are a few recommendations. The framework (Figure 2) states that a mediating factor and a tool such as educational software and relevant ICT are required for the successful integration of ICT into school curricula. In terms of the acquisition of educational software and relevant ICT (i.e. subject-specific learning programs) financial assistance is required. With the e-Education policy advocating for full integration of ICT into

school curricula it would be expected that funds have being allocated to achieve this goal. However there seems to be a lack of funds allocated for the acquisition of ICT resources (i.e. education software) which inhibits progress towards a realisation of the goals of curriculum integration. With a policy already in place this seems to be an issue of a lack of clear guidelines, specifically with reference to the allocation of finances. It is clear however that the current efforts to integrate ICT into school curricula are not effective. In Europe, the Expenditure Review Initiative (ERI) was started in 1997 to provide a systematic process of evaluation (DoES, 2008). The objective of this initiative was to analyse spending in a systematic manner and to provide a basis on which well informed decision could be made on priorities among governmental initiatives (*ibid*). Therefore a recommendation for this thesis is that authorities should make certain that e-Schools coordinators liaise with the schools to ensure that money allocated for the schools is received by the schools and that it is used for the acquisition of ICT resources. This can be achieved by having regular visits to the schools and taking accounts of whether money has been received by the schools and what this money is being used for. Nonetheless the problem seems to be bigger than poor coordination of financial resources. There also appears to be a lack of clear guidelines for implementation. In his research Sekgwelea (2007: 238) indicated that *"apart from seminars/workshop discussions as one way of enlightening the staff about technology there is also the question of how often strategy and adoption measures are shared through communication"*. Therefore to ensure appropriate integration of ICT into school curricula the framework (Figure 2) proposes that educational authorities should ensure that the motives for this goal are clear. This can be achieved by providing information sessions to the educators whereby the motives of the governments are clearly communicated. Furthermore a platform can be provided for teachers to engage with the workshop coordinators to clarify any misunderstandings. Educational authorities should also provide well defined guidelines for its implementation.

Lastly the goal of both the DoE and educators (Figure 2) is to improve ICT skills amongst educators and to ensure teachers are competent in using educational tools. With this goal, ideally teachers are expected to be adequately trained on how to master educational programs and to integrate them into the full school curricula. The findings however indicate that most teachers were only given basic computer literacy training which was inadequate for their needs. As a result very few teachers were teaching using subject-specific educational software. In explaining the reasons for the basic computer literacy training, participants mentioned that educational authorities felt that educational software was easy to use and therefore the educators did not require specialized training (KH_M10; KH_M20; KH_M53). Furthermore teachers were trained to have skills for their own benefit and not on how to teach using computers (KH_M53; MC_F11; MC_F24). Studies done by Hepp *et al*., (2004: 4) indicate that *"well-trained and motivated teacher can improve the learning conditions with*

ICT". This thesis therefore recommends that, educational authorities should invest in teacher training programs by revising the aims for the training process and ensuring that resources are allocated to aid the training process. Furthermore authorities should ensure that competent facilitators are appointed to train educators by giving regular training and mentoring sessions to the facilitators to. Also the training programs provided should be revised. Whilst basic skills as well as general computer literacy are important, the work activity framework presents a need for technically skilled teachers as a basis for a successful integration of computer technology into curricula. In other words it is only when teachers are skilled that they will be able to use educational technology to facilitate teaching, therefore emphasis should be placed on helping teachers to master subject specific learning programs, before expecting them to use them in their classes.

6.5. Future Research

Despite the fact that the study was limited to understanding the factors affecting the successful realization of the governments' e-Education policy goal, it would be useful to do a study that focuses on bridging the gap between policy creation and policy implementation. With the focus mainly on ensuring that policy implementation strategies (i.e. ICT integration into schools' curricula) take into consideration the factors (such as technologies) that exist within the respective schools.

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*UN **see** United Nations.*

*UNDG **see** United Nations, Development Group*

*UNECA **see** United Nations Economic Commission for Africa*

*UNESCO **see** United Nations Educational, Science and Cultural Organization*

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APPENDICES

Appendix A: Interview Questions for Educators

Research Questionnaire

for

Educators (not teaching ICT related subject)

The questionnaire enquires into: access and use of ICT for teaching and learning in disadvantaged communities in the Western Cape, South Africa. This enquiry will help fulfil the purpose of the study which is to understand the status of ICT deployment, and its integration into the curriculum in disadvantaged schools in the Western Cape. The main objective of the study is to gain insight into the status quo and its causal factors, so as to inform remedial efforts. The questionnaire will make enquiries into the following:

Main Research Question: What is the status of ICT deployment, and its integration into the curriculum among disadvantaged schools in the Western Cape, South Africa?

Importance of computers and learning programs

1. I have heard from the news and from the government that there is something about computers in schools have you heard about it too? ① Yes ② No

   (I am just wandering what would a computer be used for in a school anyway)

2. What would people be doing with computers any way? (Internet searches, email, learning programs, learning)

   2.1. For personal use? *(what!)*

   ……

   For education purposes? *(what!)*

   ……

   **** (direct the programs to learning programs)*

3. Are you talking about learning programs? ① Yes ② No

   1.1. If ***yes*** can you name any learning programs?

   …… Do you have these learning programs? ① Yes ② No

   1.2. If ***yes***, do they help the learners with the subjects that they struggle with? ① Yes ② No

   1.2.1. In general what are the signs that show that a pupil is improving in their subjects? *(e.g. marks)*

   ……Do the learners show these signs of improvement?

   …… So do you find computers to be important in schools? ① Yes ② No

   **** (can you clarify why it's important)*

   1.3. Why are they important?

   ……

   But couldn't you do it with out the computer and why or why not? *(expecting to say you could use it but yes its better).*

   ……Since the learning programs are supposed to help the teachers with their learning would you say it ***easy or difficult*** to these learning programs?

   ……

   1.3.1. If the learning programs are ***difficult*** to use **why** are they ***difficult*** to use? (is it difficult to use the programs because of lack of training)

   ……Do teachers get training to use or teach with these learning programs? ① Yes ② No

   1.4. If ***yes*** where do they get their training?

   ……Who provides the training? ……

   1.5. What do they teach you in the training?

   ……

   1.6. How successful are these training programs?

   ……

   1.7. Are the learning programmes easier to use after the training? ① Yes ② No

2. If ***no*** training, ask for explanations (also whether they are considered important)

…… If the learning programs are easy to use then is everyone teaching with them? ① Yes ② No

   2.1. If ***no*** why?

   ……

   …… Do you have a computer? ① Yes ② No

2.2. If ***yes***, how did you learn how to use a computer? (*teach yourself, training, learnt from friend, learnt from colleague etc).*

……

2.3. If ***no*** why don't you have a computer?

.....

2.4. Have you heard about the teacher laptop initiative? ① Yes ② No

2.5. Have any teachers in your school received any laptops from this initiative?

.....

Learners at school

3. How many learners are in the school?

……..

3.1. How many of them are being taught using the computer?

.....Why only this number?

..... In what school-grades are computers being used?

.....

4. What is the number of subjects that have a computer facilitated component?

……..

4.1. What subjects *(within the school grades mentioned above are these*) are these?

.....

Why only these subjects? *(ask – what about the others)*

.....

Which subjects require online access to the Internet)?

……..

4.2. How are the computer programmes being used f*or teaching (e.g. research, assessments, administration)*

.....

4.3. When it comes to teaching these subjects couldn't you just teach without using computers, would you rather teach without learning programs?

4.3.1. Why or why not?

.....

Learners using computers

5. How do the learners feel about using computers? *(Do learners like using computers)*

.....

6. How are they responding? (is it good or bad)

.....

7. Do they struggle with using computers?

……

8. How do they show that they are interested or not interested in computers?

……

9. How are the learners supported when they have difficulty in using computers?

……

10. Is there someone from government who provides support for learners? *(e.g. training)*

ICT training for teachers

11. How many teachers does your school have? ……..
12. How many of these teachers are ***able*** to use computers? ……..
13. How many teachers are using computers for teaching?.....
    13.1. What do they do with these computers?
    ……
    ……
    13.2. How do they use these computers?
    ……..
    13.3. Why are others ***not*** using computers for teaching?
    .....**oth**
    er
14. Is there a dedicated teacher to manage ICT facilities and to champion the use of ICT?

Appendix B: Interview Questions for ICT Coordinators

Research Questionnaire

for

ICT Coordinators

The questionnaire enquires into: access and use of ICT for teaching and learning in disadvantaged communities in the Western Cape, South Africa. This enquiry will help fulfil the purpose of the current study which is to understand the status of ICT deployment, and its integration into the curriculum in disadvantaged schools in the Western Cape. The main objective of the study is to gain insight into the status quo and its causal factors, so as to inform remedial efforts. The questionnaire will make enquiries into the following:

Main Research Question: What is the status of ICT deployment, and its integration into the curriculum among disadvantaged schools in the Western Cape, South Africa?

Importance of computers and learning programs

4. I have heard from the news and from the government that there is something about computers in schools have you heard about it too? ① Yes ② No

   (I am just wandering what would a computer be used for in a school anyway)

5. What would people be doing with computers any way? (Internet searches, email, learning programs, learning)

   5.1. For personal use? *(what!)*

   ……

   5.2. For education purposes? *(what!)*

   ……

   **** (direct the programs to learning programs)*

6. Are you talking about learning programs? ① Yes ② No

   14.1. If ***yes*** can you name any learning programs?

   ……

15. Do you have these learning programs? ① Yes ② No

   15.1. If ***yes***, do they help the learners with the subjects that they struggle with? ① Yes ② No

   15.1.1. In general what are the signs that show that a pupil is improving in their subjects? *(e.g. marks)*

   ……

   15.1.1.1. Do the learners show these signs of improvement?

   ……

16. So do you find computers to be important in schools? ① Yes ② No

   **** (can you clarify why it's important)*

   16.1. Why are they important?

   ……

   16.2. But couldn't you do it with out the computer and why or why not? *(expecting to say you could use it but yes its better).*

   ……

   16.3. Since the learning programs are supposed to help the teachers with their learning would you say it ***easy or difficult*** to these learning programs?

   ……

   16.3.1. If the learning programs are ***difficult*** to use **why** are they ***difficult*** to use? (is it difficult to use the programs because of lack of training)

   ……

   16.4. Do teachers get training to use or teach with these learning programs? ① Yes ② No

16.5. If ***yes*** where do they get their training?

……

16.6. Who provides the training?

……

16.7. What do they teach you in the training?

……

16.8. How successful are these training programs?

……

16.9. Are the learning programmes easier to use after the training? ① Yes ② No

17. If ***no*** training, ask for explanations (also whether they are considered important)

..... If the learning programs are easy to use then is everyone teaching with them? ① Yes ② No

17.1. If ***no*** why?

..... Do you have a computer? ① Yes ② No

17.2. If ***yes***, how did you learn how to use a computer? (*teach yourself, training, learnt from friend, learnt from colleague etc).*

……

17.3. If ***no*** why don't you have a computer?

.....

Have you heard about the teacher laptop initiative? ① Yes ② No

17.4. Have any teachers in your school received any laptops from this initiative?

.....

ICTs Potential and its availability in schools (ICT Coordinator)

Deployment of ICT into schools

18. Does the school have computers? ① Yes ② No

19. If ***yes***, how did the school acquire these computers? *(e.g. purchase, rent, donation)*

.....

What are the computers generally used for?

.....

19.1.1. Who looks after them?

……

19.1.2. Where are they kept?

……..

19.1.3. Are they not misused by the learners or teachers? ① Yes ② No

19.2. How many computers does the school have?

……..

19.3. On average how many learners per computer?

……

19.4. Why does the school only have this number of computer?

.....

20. How many of the computers are working? *(Refer to question 6).....*

20.1. If other computers are not working why are they ***not*** working?

……

20.2. What happens when the computers in the school stop working, who fixes them?

……

20.3. How long does it usually take for the computers to be fixed?

……

21. When computers are first brought into the school, who sets it up?

……..

21.1. How long does it this take?

……

22. If ***no computers***, why are there no computers at the school?

.....

22.1. Is there something been done in the school about the lack of computers and what is it? *(projects, government Initiatives etc.)*

.....

23. **Where there are *no* computers:** where do you go to access computers? *(E.g. Internet Café, ICT centre etc.)*

.....

Telecommunication Potential and Internet access in schools

24. Does the school have electricity? ① Yes ② No

24.1. If ***no***, why not?

.....

25. Does the school have a telephone line? ① Yes ② No

25.1. If ***no***, why not?

.....

26. Does the school have Internet? ① Yes ② No

27. How many computers have an Internet connection? .....

27.1. Why only this number?

.....

28. Are learners allowed to use the Internet or is the Internet only for staff members?

……

28.1. Is Internet for free or is there a limit?

……

28.1.1. What is the limit for learners?

……

28.1.2. What is the limit for teachers? ……

28.1.3. Is this enough, do the learners and staff members generally complain about not having access?

.....

28.1.4. Why is there such a small amount of Internet bytes allocated for learners and staff members?

.....

28.2. Is the school doing something about the lack of Internet? ① Yes ② No

28.3. If ***yes*** what is been done?

……..

29. On average are staff members and learners expected to make use of the Internet for academic purposes?

① Yes ② No

30. What do the staff and learners use the Internet for?

.....

Learners at school

31. How many learners are in the school?

……..

31.1. How many of them are being taught using the computer?

.....Why only this number?

..... In what school-grades are computers being used?

.....

32. What is the number of subjects that have a computer facilitated component?

……..

32.1. What subjects *(within the school grades mentioned above are these*) are these?

.....

33. Why only these subjects? *(ask – what about the others)*

.....

34. Which subjects require online access to the Internet)?

……..

34.1. How are the computer programmes being used f*or teaching (e.g. research, assessments, administration)*

.....

34.2. When it comes to teaching these subjects couldn't you just teach without using computers, would you rather teach without learning programs?

34.2.1. Why or why not?

.....

Learners using computers

35. How do the learners feel about using computers? *(Do learners like using computers)*

.....

36. How are they responding? (is it good or bad)

.....

37. Do they struggle with using computers?

……

38. How do they show that they are interested or not interested in computers?

……

39. How are the learners supported when they have difficulty in using computers?

……

40. Is there someone from government who provides support for learners? *(e.g. training)*

ICT training for teachers

41. How many teachers does your school have? ……..
42. How many of these teachers are ***able*** to use computers? ……..
43. How many teachers are using computers for teaching?.....

43.1. What do they do with these computers?

……

43.2. How do they use these computers?

……

43.3. Why are others ***not*** using computers for teaching?

……

Other

44. Is there a dedicated teacher to manage ICT facilities and to champion the use of ICT?

……

45. What are the causal factors of the current status of ICT deployment at your school? *(Explanations to the status of ICT deployment, i.e. why no computers)* **(ICT Coordinator)**

……

Appendix C: Letter of Request to the Western Cape Department of Education

101 Omega Block
Centreville
Constitution Street
Zonnebloem
Cape Town
8000

4 September 2010

Western Cape Education Department
Private Bag 9114
Cape Town
8000

Dear Sir / Madam

REQUEST FOR PERMISSION TO CONDUCT RESEARCH IN WESTERN CAPE SCHOOLS

This is a letter to request for permission to conduct research in disadvantaged schools in the Western Cape, South Africa.

I am a masters student at CPUT, my supervisor is Professor Mlitwa. My thesis is titled: Access and use of ICT for teaching and learning in disadvantaged schools in the Western Cape, South Africa. Currently I am in the data collection phase of my research, whereby I need to conduct interviews and distribute questionnaires to ICT coordinators and teachers in disadvantaged schools in the Western Cape.

As per procedure, permission is required by the Western Cape Department of Education (WCED) to conduct research in schools. Therefore I would like to kindly request for permission to conduct my research in disadvantaged schools in the Western Cape.

Yours Sincerely
Kesewaa Koranteng

Email: kesewaajkoranteng@gmail.com
Cell: 072 4189 262

Appendix D: Letter of Permission from the Western Cape Department of Education

Navrae
Enquiries Dr A.T Wyngaard
IMibuzo
Telefoon
Telephone 021 467 9272
IFoni
Faks
Fax (021) 425-7445
IFeksi

Verwysing
Reference 20101027-0040
ISalathiso

Wes-Kaap Onderwysdepartement

Western Cape Education Department

ISebe leMfundo leNtshona Koloni

Miss Kesewaa Koranteng
101 Omega Block Cenreville
Constitution Street
Cape Town
8001

Dear Miss Kesewaa Koranteng

RESEARCH PROPOSAL: ACCESS AND USE OF ICT FOR TEACHING AND LEARNING IN DISADVANTAGED COMMUNITIES IN WESTERN CAPE, SOUTH AFRICA

Your application to conduct the above-mentioned research in schools in the Western Cape has been approved subject to the following conditions:

1. Principals, educators and learners are under no obligation to assist you in your investigation.
2. Principals, educators, learners and schools should not be identifiable in any way from the results of the investigation.
3. You make all the arrangements concerning your investigation.
4. Educators' programmes are not to be interrupted.
5. No research can be conducted during the fourth term as schools are preparing and finalizing syllabi for examinations (October to December).
6. Should you wish to extend the period of your survey, please contact Dr A.T Wyngaard at the contact numbers above quoting the reference number.
7. A photocopy of this letter is submitted to the principal where the intended research is to be conducted.
8. Your research will be limited to the list of schools as forwarded to the Western Cape Education Department.
9. A brief summary of the content, findings and recommendations is provided to the Director: Research Services.
10. The Department receives a copy of the completed report/dissertation/thesis addressed to:

We wish you success in your research.

Kind regards.
Signed: Audrey T Wyngaard
for: **HEAD: EDUCATION**
DATE: 25 October 2010

Appendix E: Research Participants' Consent Form

No 80 Roeland Street
Cape Town
IT Department
Commerce Building Room 1.4

Access and Use to ICT for teaching and learning in disadvantaged communities in the Western Cape, South Africa

Dear Sir/Madam

Due to the legacy of apartheid, the South African education is still facing development discrepancies between the urban and rural schools. Unless these development discrepancies are addressed, the quality of education will remain compromised in affected communities.

About the Study

It is understood that policy makers, the public and the private sector are making efforts to redress development imbalances between the well developed and the disadvantaged schools. The aim of this study is to understand the status of ICT deployment, and its integration into the curriculum in disadvantaged schools in the Western Cape. The objective of this investigation therefore, is to gain insight into the status quo and its causal factors, so as to inform remedial efforts.

Request to you

With your experience with the use of ICT in schools, we trust that you can share your experiences. I kindly request your participation in a short research interview (to take place in your office) on status of ICT deployment and its integration with the curriculum at your school.

About the interview

The interview will take between 20 and 30 minutes. To ensure confidentiality of information, no attempt will be made to identify you with responses you make to the interview. So you free to respond without any fear of victimization. Findings will be used for academic purposes, and recommendations may be used only to inform improvements, with no reference to the identity of the sources. Finally, this research is authorized by, and is in full compliance with the guidelines of the CPUT HDC research ethics committee guidelines.

Thank you for participating

Agreement to participate:

I'm participating in this study out of my free will. I may refuse to participate, or can stop participating at any time, without being penalized for doing so. If I wish, I will be given a copy of this consent.

I,……..hereby accepts the invitation to participate in this research interview as outlined above. Signed at …… on this _____ day of _____ 2010

Signature_____

Appendix F: Sample of Interview Transcripts

Interview Transcripts: Educators

Question

Just from the news in news papers and magazine you hear that there is something going on about computers in schools have you heard about computers in schools you know from the government or anything like that

SM_M1

Mmh, yes I do heard about that but at the moment we don't have laptops, but we do have a computer room, computer lab

Question

So, just in general what would you say people use computers for?

SM_M2

Mmmh, … some of the teachers are using the computers for the maths lessons, others when they are preparing for the class, lets say like me, I'm going to write a test tomorrow, the kids are going to write a test tomorrow, so

Question

So, when you talk about using the computers for typing and for maths are you referring the learning programs?

SM_M3

Ya, learning programs

Question

What learning programs do you know

SM_M4

Mmmh, maths and even in languages we do use computers

Question

Am what I am say is learning programs, like lets say master maths, that kind of thing?

SM_M5

Eeh, I am not sure about that, hee, I am not sure really

Question

Are you a teacher for a specific subject?

SM_M6

Ya, I am a Xhosa teacher, all the grade 9s, Xhosa

Question

Since you don't use the learning programs for the your subjects, what about the subjects that are taught using learning programs, for example maths or science, do you think those teacher struggle when it comes to using the learning programs

SM_M7

No, I don't think they struggle, because they have a little bit knowledge of how to use a computer, I don't think they are struggling, because during the maths class come to the computer lab. mmmh

Question

What about instances when they struggle, is there training available?

SM_M8

Yes, there are some training available , like am there was the Khanya project, whereby they trained teachers, mmh.

Question

So when it comes to learners using computers for the maths and science and all of that, do you think they help the learners to improve in their maths and science

SM_M9

I think so, ha ah, yes

Question

So would you say computers are important and why?

SM_M10

Ya, they are very important, most specially the new technology, because if a learner is busy with a project he have to go to computer so computers are very important these days

Question

So what would they be doing on the computer that makes it better than doing it by themselves you know without the computer. What is so special about the computer that they can't work without it

SM_M11

No, there are these programs, the newly installed programs for maths and they go to google where they get more information there. So I think its better when their using the computers than themselves, because computers help them. Yes computers help the kids to find out more information

Question

Ok, even for teachers do you think the learning programs are easy to use.

SM_M12

Eeeh, yes I think so, because you know before going to class you need to sit down and prepare for the class. So you have to have more information so that when the kids ask you must be able to know. You must be able to know your learning area by having more information

Question

You were saying that there is training provided by the Khanya was that for both learners and teachers or for teachers alone

SM_M13

It was for the teachers, I am not sure about the learners

Question

What did they teach the teachers in the training program

SM_M14

There was a aaa, computer, to be computer literate, to know more about computers how to open the computer, when you want to type all those sort of things

Question

So you are saying that learning programs and computers are easy to use after the training or do the teachers still struggle to use some of the things

SM_M15

No, its you its easy after the training because at least you have that knowledge of how to operate a computers, mmh

Question

So you were saying that you are a Xhosa teacher so there is no program to help your learners learn Xhosa

SM_M16

No, sometimes there are, like when you want them to investigate something, so they have to go to computers and search that.

Question

But in terms of a learning programming there is no learning program for Xhosa

SM_M17

Eeh, I am not sure, because I aaa, I never took them to computer lab I always use some resources, rather than icomputer

Question

So not every teacher uses the computer in the classroom

SM_M18

mmh

Question

Not every teacher uses the computer inside the classroom

SM_M19

Oh, no we don't have a computer inside our classrooms

Question

You only use it for maths and science

SM_M20

Ya, the computers are only here in the computer lab, not in the classroom, even, its only the secretaries who have computers in the admin block.

Question

What about you do you have a computer

SM_M21

Yes, I do have at home,

Question

How did you learn how to use a computer, do you learn by yourself or through that training that you mentioned or maybe at a tertiary institution

SM_M22

Yes, one time even though I didn't finish up. I attended the lessons here are school, mmh, of how to operate the computers and all that stuff. At least now I know how to open the computer, how to save and other stuffs, I just prepare my lesson in the computer.

Question

Have you heard of the teacher laptop initiative where the government wants to give laptops to all the teachers?

SM_M23

Ya, I've heard about that

Question

So you got a laptop from the government

SM_M24

Hmh, not yet

Question

And then what is the arrangement and would you be able to afford the arrangement by the government

SM_M25

Mmmh it seems as if ,because there are other guys who came and talked to us about the arrangement it seems as if it's a little bit expensive, because it seems as if the government is going to subsidize us so we have to buy a computer and its seems as if it's a little bit expensive

Question

How many learners are in the school

SM_M26

Mmh, its they, I am not sure about the exact number, but they are more than 1000, mmh

Question

Do you know which school grades computers are been used for teaching

SM_M27

Hhhm, all grades

Question

What other subjects aside for maths and science are computers been used to teach

SM_M28

Mmh, eh, I think its, I'm not sure

Question

What are the learners attitude to the computers when they come to the computer labs do they like coming or not. Do they struggle sometimes

SM_M29

Nooo, I think they like to come to computer lab

Question

And sometimes when they find it difficult to use the learning programs is there training available for them to use the learning program

SM_M30

Ya, by those teachers, its like in maths, the maths teacher help them, mmhmm, because even when they come to the computers they don't come alone, because the teachers come and assist them with what they want to know in that program

Question

You mentioned that computers are important and that they make the learning easier. Wouldn't it be better for you to teach with them

SM_M31

Ya, because sometimes you have to, if you didn't type your notes and the other stuff, you know that you have to write on the notice board, so when you are having the computer I think it will be better because everything is there. You are going to use the monitor and they stuff than writing on the notice board, mmh

Interview Transcripts: ICT Coordinators

Question

The government says they want to put computers into schools right, so do you know about all of that the government wanting to put computers into schools

SM_D1

Ya, it is true it is true, because most of the schools have been provided with computers the this one we got the computers from Khanya, it's a sort of a project they call the Khanya project, they install these computers in 2005, yes and I know of other schools also in G and also all the other schools in fact have got these computers installed and now that since this one of our has long been installed and now they must come and renew them. I don't know when they are coming back to install others or to renew these computers because they are now old now mh, like I've got a problem with the server the Internet is not working, but I am waiting for electricians to come to our rescue.

Question

In terms of the uses of computers what would you use a computer for anyway,

SM_D2

Aah I would think that you can use a computer also for research purposes and assignments you know for making assignments, because most of the students who are given work by teachers they usually come to search for information here in the computer room. Some of them are coming for Master Maths and physical science, things like that you know

Question

So would you say computers are important

SM_D3

Yes, off course, yes, they are off utmost importance

Question

Can you name the learning programs

SM_D4

Some of these programs have been installed in the computer like the one I just mentioned, master maths and we have got also mindset which features all the other subjects like geography, aah life sciences and all those things, you see. So it depends on which program they want to come here for some of them they want to come here for life orientation things like that you know

Question

Do you think that the learning programs help the learners and how do you see that. Maybe their marks improve or something like that. How would you say the learning programs help the learners?

SM_D5

Ya, I would say that they help the learners in the sense that some of the information that the learners cannot find in the laboratory they easy come here and surf it on the Internet aaah some of them as I have mentioned this program of master maths its helping them in Mathematics, and in as much, I can see that there are also assessment programs within the master maths itself and there are tests there that the computer does the marking on its own.

Question

So when it comes to things like maths and science couldn't you or the learners do the subjects without computers.

SM_D6

No the students can do these subjects mathematics and science without the computers as they did in as much as its not that they always come here, these computers are not intended for teaching as such, but it is just intended as additional resource centre you see. Yes because why they only come here once a week, all classes are catered for once a week.

Question

If learning programs are supposed to help the teachers to teach the children would you say they are easy to use or difficult to use

SM_D7

No, I would say that… I can say that they are easy to use because you just follow the instructions, because all the instructions are there so the kids can just use it, just following the the whats the name the buttons themselves, because they already know what to do

Question

So you are saying its easy for both teacher and learner

SM_D8

Yes, its very easy and its also convenient because some of the learning areas that were not explained by the teacher they can get them better on the computer, because these are audio visual equipments

Question

Can you give an example of the program that you are talking about

SM_D9

Yes, I am talking about for instance in my subject as a mathematics the program that I have got here called master maths as well as another program for science that they call multi choice

Question

Are those the only programs that you have

SM_D10

Those are the only 2 programs that I have, as I have just said earlier on we also have another program also by the name of mind set where you can get learning areas in geography, life orientation and life sciences and so on. Both from grade 10 – grade 12

Question

In instances where lets say teacher try to look into the manual and they are not able to still use the software is there training available to train the teachers to be able to use the learning programs

SM_D11

Yes, in fact eh ever since we installed these computers all teachers in the school has attended a course in computer literacy, so all of them are capable of using the software

Question

Where was the training and who provided them

SM_D12

The training was done here at the school which was provided by the very same people who gave us these computers who subsidized these computers to the school by the name of Khanya project.

Question

So would you say that these programs are successful and how are they successful am do you see and improvement in the learners marks or something like that?

SM_D13

Yes, I would say that there is an improvement because there is a slight improvement in the pass rate regarding grade 12

Question

When you mentioned the training you said they only taught you computer literacy so they didn't teach you to use specific learning programs?

SM_D14

Yes, in fact when I mentioned that the teachers were given education in computer literacy so that those teachers who did not know computers could at least have a back ground as to type their own question papers and as such

Question

In terms of the teachers who have never used the computer since they have been taught computer literacy do you think that the basic computer literacy is enough for the teacher to teach the learners in a an easier way that they can understand?

SM_D15

In fact the teachers that were offered this education does not imply that they were taught to teach students they were just taught for their own benefit, to type their own papers and so on. So that's why I say it was a computer literacy for them and not for the students. In fact we have not yet introduced computer literacy as a subject here at school, so I think that is still in the pipe line maybe in years to come maybe we will introduce a ah computer literacy as a subject on its own or as a learning area, but for now we are just using this computer room mostly for master mathematics and science

Question

You said the learning programs are easy to use so is every teacher using them

SM_D16

Yes, all the teachers who are concerned in those subjects they bring their students to use those programs when they have got their own periods, because we've got a timetable here at the school whereby ah these classes come to this computer room at least once a week

Question

In terms of computers do you have your own computer?

SM_D17

You mean a personal computer at home, yes I've got one at home, but now we are busy trying to. There were people who came here to subsidized with some laptops of which they are going to come aah next month as it was promised by the president, that all teachers will be given laptops, but as I understand now these computers are a subsidized. There is a certain amount of money that teachers must also pay out in order to get these computers, yes

Question

How did you learn how to use a computer

SM_D18

In fact eh I understood a computer because I did further education in mathematics at U , with this course, what do you call this course again. In fact I did FDE at U were we also did computer literacy

Question

In terms of the computers at school you said all of them were subsidized by the Khanya project

SM_D19

Yes

Question

So, who looks after them and do you have a problem with students misusing them?

SM_D20

Ya, as I am the lan administrator I must see to it that every computer is always in tact and if ever there is anything wrong which happens to the computer, I always report them to my helpdesk whereby I will get a claim number there where they will send a technician to come and fix whatever needs to be done. Yes, the other thing I have just forgot is that the students are very much misusing these computers. at this stage I've got 4 mouses that have disappeared and sometimes also the electrical wires also attached to the computers are stolen. Like for instance the head phone I have got a problem with head phones in as much that most of them are not working in a good fashion

Question

How many computers does the school have in total

SM_D21

We have go about 25 computers here in the computer room and we have got aah 2 at the secretary office and we have 1 at the principals office which makes it 28 in total

Question

How many learners are in the school and on average how many learners per computer do you have at a time

SM_D22

We have go about +- 1370 enrolled students aah per computer the students are seated in 2s so it makes it that this computer lab accommodates 50 students

Question

Do you manage to accommodate all the students with 25 computers amongst 1370 students

SM_D23

Yes, because these students they come here periodically, so at least all of them have a chance, we've got a 5day cycle in which the students in each class must come for master maths in particular as I have just mentioned, but after school most students come here to make some research for their assignments and so on so at least after school we accommodate them form 3 o'clock to 3:30.

Question

I am sure the school would like more computers, why does it only have this number 28 computers

SM_D24

In fact there is a second laboratory that is still under way, but eh we have already installed I think 24 computers already there but eh its not yet functional

Question

How many computers within this current functioning lab are working

SM_D25

Currently I think those that are working they are about let say 18 yes, because some of them due to to to aging ya they are dysfunctional and that they need to be renovated.

Question

What about the new lab that you are setting up, how is that going and how long has it been since you started setting them up. When you have problems with the computers how quickly do they get fixed

SM_D26

Ya, otherwise we are still waiting for Khanya project to come and eh give us other computers because these ones are aging and am the other computer lab that I was talking about was initiated middle of the year of which I am not quite certain as to when it will be fully functional

Question

So when there is a problem with the computer you mentioned that you call the helpdesk. Does the problem get fixed quickly, how is service and their response when you call them

SM_D27

Their service was good initially but I am very much disappointed. Ever since we opened after S…. I have a problem with the Internet the server does not read the Internet and I have been phoning them time and time again and now it's the third week this Internet is not working, in as much as now even for making a register aah the teachers register we have to go to the next school next door

Question

In cases where the students cannot use the computer labs here where can they go to access the Internet or a computer

SM_D28

If these computers are not available the students usually go to their respective community libraries to go and search for information

Question

When the Internet is function properly how many computers have Internet access,

SM_D29

When the Internet is functioning properly I think I've go round about 21 computer that are connected to the server and the Internet is functioning only 4 of them that are not connected.

Question

In terms of the internet access you said only 21 out of 28 computers have Internet, what about the rest why, why don't the others have Internet access

SM_D30

Ya, the problem that they don't have access is only I've got a problem with the port, ya the port ya some of the computers are not connected to the port. As I have said this computer room the the some of the computers needs to be fixed up by technicians, but now the thing is since these computer room has been functioning for

over 5 years and now they are out of warranty or guarantee from the people who installed them so its now the duty of the school to keep them up to date and sometimes it becomes very much expensive for the school you know

Question

When it comes to the Internet access is it for free, can both staff and learner use it and what is the limit

SM_D31

In terms of the usage of the Internet we use Iburst we are connected by iburst of which we pay iburst a fixed amount of R2300 per month so when ever the teachers want to use or the office want to use the Internet they are free to do so at anytime there is no limit because we are paying at a fixed amount of R2300 and for the students, the students only have access when they are accompanied by their respective teacher on their period or maybe they would come after school as from 3 o'clock to 3:30 as I have mentioned earlier when they have come for research purposes

Question

Would you say that is enough time especially when they are limited to using the Internet in their study period or ever after school do you think that is enough Internet access for them

SM_D32

Yes that is enough Internet access for them because they don't always come for the Internet, so if they are given a project form their respective teachers they can come for 30mins each for the whole week so 30 x 5 is 150mins

Question

On average do the staff members use the Internet for academic reasons or for personal reasons do they use the Internet for email or maybe to help them with their school am or to help them with their teaching

SM_D33

Ya, I can say it depends on the individual teacher himself as he comes here whether he has come here for his personal reasons or maybe he has come for educational purposes so I would say on average they usually come to search for their information in their respective subjects.

Question

You mentioned before that there are about 1300 learners are all of them been taught with a computer or how many of them are been taught with a computer and which grades do they teach the subjects with the computers (which grades do the teachers teach with computers)

SM_D34

As I have mentioned this computer lab is mainly for master maths we don't have access for other learning areas other than for mathematics and for science as I have mentioned. So the only thing that I have noticed is when they come here they come here to surf for their respective information maybe for assignments or projects, so there is no specific learning area either than maths and science that they come here for.

Question

So maths and science for grade 8 – grade 12?

SM_D35

That's right, yes that's correct its maths and science from grade 8 – grade 12

Question

Why are the learners only been taught maths and science with the computers, what about the other subjects

SM_D36

First preference have been given that this lab should cater for maths, because most students fail maths that's why we need to have a program that caters for maths and science because those are the 2 key subjects that were identified as been particularly failed by most students that is the reason

Question

OK do you not cater for the other subjects, because of choice or because of financial reason, by choosing to only use the learning programs for maths and science, aren't you missing out on the benefits of computers for teaching other subjects

SM_D37

As I have just mentioned there is a second laboratory that is going to cater for all these other subjects, but eh as I have said its still not yet functional, I don't know when its going to function. But these ones is particularly for maths and science that is why those people who subsidized these computers told us that is the Khanya project they said this laboratory is specially for mathematics and science and then that laboratory will cater for all other learning areas that we have just mentioned because the would be called the CAT laboratory

Question

What subjects would those other computers be catering for,

SM_D38

the second laboratory will be catering for all other subjects that are not included here, yes including life orientation.

Question

Can you name the subjects

SM_D39

Eeh natural science, iam sorry geography, accounting, history and what else yes

Question

What subjects are been taught in the school

SM_D40

Yes its eh Xhosa, English, History, Geography, Mathematics, Financial Mathematics, Accounting, Business Accounting, Life Science, Life Orientation, Technology

Question

With the computers since they are used for maths and science, couldn't the teachers teach those subjects without a computer or learning programs?

SM_D41

I think the thing that they come here is also to come and catch up for extra resources, as I have said the computers does not replace the teacher the students usually come here for practice purposes, because in the computer you usually find that there are more exercises and aah and test that you can get, here in the computer and it has got eeh questions and answers, yes

Question

So do you find computers to be a need or important with the teaching those subjects like maths and science

SM_D42

Yes, yes I would say so, because they also give, they also give additional knowledge to the students

Question

You were saying it is easy to use the programs because of the help tools do you think they learners like using the computers and how do they respond when having to use the computers, and having to do the maths and science on the computers

SM_D43

Yes, I can say that they enjoy it very much, because they even like even the coming here to the laboratory and having to get information from another source other than the teachers that they usually encounter in their daily lives

Question

Do the learners not struggle and is there training available if they do struggle

SM_D44

No they don't struggle because whenever they come here they come with the assistance of the teacher they don't come on their own, so after they have mastered the use of the computer they also come now on their own without the teacher

Question

So there is no extra training provided by the government or something

SM_D45

Ya, no there is no other additional training provided its only the teachers who guide their own respective students

Question

How many teachers are in the school

SM_D46

We have about 38 staff members

Question

How many of these are able to use a computer

SM_D47

Most of them are able to use the computer its only maybe a small percentage, but I doubt it now, all the teacher that are here, I think they are computer literate, I usually see them here in the computer room.

Question

So you would say all 38 of them are able to use the computer

SM_D48

Yes, 38 of them are able to switch on the computer and go on with whatever they want to do

Question

What about for teaching

SM_D49

As I have just said for teaching at the moment its only those teachers who come for mathematics and science, because we don't have programs for other subjects that I have just mentioned.

Question

How many ICT coordinators do you have, like people who are in charge of the computers and all of that

SM_D50

If you want to know about the committee maybe

Question

Coordinators

SM_D51

Coordinators we are about 3 coordinators

Question

When you look at the school why are there only 25 computer is because of the finance, lack of support, why is it that the technical issue are not dealt with quickly.

SM_D52

Yes, as I have just mentioned its because these computers have been sponsored by the Khanya project not by the government so Khanya is an organization on its own which has got nothing to do with the government so as to say so they also do this on their own, no body forces them and these are the people who have sponsored us, so actually there is no way we can cry over them because they are the once who are giving us help so the government has got nothing to do with them. So there is no way if things don't go smoothly and swiftly as I have thought, I cannot blame, because they are also trying to help so its an NGO project I can say

Question

In you point of view are you satisfied with the number of computers at the school what would you ideal situation in terms of computers in terms of networking in terms of subjects, what would your ideal situation be

SM_D53

Ya, no if ever we can get a second laboratory I think this computer business would be a smooth running one, because as you have just mentioned the other learning areas are also complaining that they also want to be included to come to this laboratory, but as I have just said eeh since the enrolment of the school is so big 1300 students we cannot accommodate all of these subjects in this laboratory but eh as soon as we have got the second laboratory I think it would be better then all other learning areas would also be accommodated in the second laboratory that is coming. In fact they were supposed to be 3 laboratories, but eeh as I have just mentioned the school cannot afford to buy these computers because even the students they don't even pay school fees as you know so Khanya project tried to subsidize us with these computers so even the maintenance is too high for the school to maintain.