IMPLEMENTATION OF COMPUTERS IN SCHOOLS: A CASE STUDY OF FIVE SCHOOLS IN THE MAKANA AND SOMERSET EAST DISTRICTS

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GILBERT LESLIE PRINCE

Supervisor: Prof. Cheryl Hodgkinson-Williams

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Abstract

This case study attempts to explain the implementation of Information Communications Technology (ICT) in primary schools, specifically mentioning the integration of computers into the curriculum. To begin with, the implementation of ICT from an international perspective is explored and subsequently some international and African ICT policies in education are also identified and discussed. Nationally, ICT policies from four provinces in South Africa are examined and analyzed. Provincially, the ICT Projects Coordinator in the Eastern Cape Department of Education (ECDoE) was interviewed to obtain a provincial perspective of ICT in the Eastern Cape. From local schools' perspective, four primary schools and one secondary school in the Makana and Somerset East Districts were visited and the ICT coordinators at these schools were interviewed.

The results reveal that the previously disadvantaged (PD) schools were not utilizing their computers effectively. This is due to a number of factors, including a lack of funds to maintain the computers; unskilled or under skilled teachers in ICT; and under resourced computer facilities. The previously advantaged (PA) schools, on the other hand, have well-resourced computer laboratories, adequate maintenance plans as well as skilled teachers in ICT that enable these schools to effectively integrate the use of computers into the curriculum.

Key words: Information communications technology, implementation, integration, previously advantaged, previously disadvantaged, curriculum, primary school, secondary school.

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List of Abbreviations

CBI	Computer- Based Instruction
CMC	Computer Mediated Communication
DoE	Department of Education
EC	Eastern Cape
EMIS	Education Management Information System
FDET	Former Department of Education and Training
FHOR	Former House of Representatives
FMC	Former Model C
FTP	File Transfer Protocol
GDPS	George Dickerson Primary School
ICT	Information Communications Technology
IRC	Internet Relay Chat
IS	Independent School
IT	Information Technology
KZN	Kwazulu-Natal
NGfL	National Grid for Learning
NGO	Non-governmental Organization
NIED	National Institute for Educational Development
PA	Previously advantaged
PD	Previously disadvantaged
SGB	School Governing Body
SITES	Second Technology in Education Study
UK	United Kingdom
UNESCO	United Nations Educational, Scientific and Cultural Organization
UPE	University of Port Elizabeth (now the Nelson Mandela Metropolitan University)
WCED	Western Cape Education Department

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Chapter 1

1 Introduction

1.1 Rationale for the research

This research was prompted by a donation of computers to George Dickerson Primary School (GDPS), which ultimately resulted in the installation of a computer laboratory at the school. By investigating how other schools with computers in the Makana and Somerset East Districts implemented their computers, I was interested in how suggestions from these schools could inform the implementation and integration of ICT into the curriculum at GDPS by informing the implementation process at the school.

GDPS received a donation of eighteen second- hand computers from Rhodes University's Information Technology (IT) Department in Grahamstown in 2002. The sponsoring of these computers was preceded by the writing of a proposal [Appendix A], detailing the background and specific needs of the school, as well as the maintenance of the sponsored computers, among others. A Rhodes lecturer and I, and at a later stage the ICT committee at GDPS, jointly developed the proposal. This eventually secured the sponsoring of the computers by the Rhodes IT division. In addition to this donation, Rhodes University's Telkom Centre of Excellence agreed to provide an Internet connection to the school as part of a project to network previously disadvantaged (PD) schools with Internet facilities. GDPS, where I teach, is an example of a PD school, and these sponsorships have enabled the ICT committee at GDPS, in conjunction with the rest of the staff members, to establish a computer laboratory in one of the classrooms to help learners as well as teachers to uplift the standard of learning and teaching through ICT at the school. These sponsorships prompted me to research the implementation of computers in schools, specifically to facilitate the formulation of a policy on computer implementation for GDPS.

1.2 Context of the research

Generally, computers do not only play a significant role in society, but increasingly schools are acquiring computers as an aid to facilitate learning (Guile, 1998). However, in order for learning to be effective within schools, computers have to be integrated into

the curriculum (Richards and Nason, 1999). This means that computers should not only be utilized as a tool for acquiring skills, but should also be used as a tutor (Taylor, 1980). Taylor writes that learners use computers in the tutor mode by responding to preset programs that were programmed by specialists in the field (1980). Good examples of a computer being used in this mode can be word processors and spreadsheets (Heukelman, 1994). To utilize computers in the tutee mode means that the learner should be able to instruct the computer, in other words the learner should be skilful in programming the computer (Taylor, 1980) in order to execute the desired outcomes.

A number of obstacles have to be overcome in order to utilize the computer in the above-mentioned modes in schools. The Second Technology in Education Study (SITES) conducted an international study on the implementation of computers in primary and secondary schools in 26 countries, including 222 South African schools. Their conclusion was that the major barriers for implementing computers in schools include (1) an insufficient number of computers in schools – 70%, (2) teachers' lack of computer knowledge – 66%, and (3) the difficulty of integrating Information Communications Technology (ICT) into instruction – 58% (Pelgrum, 2001). In another research project conducted by Mooij and Smeets (2001) in Dutch secondary schools, they investigated how ICT was implemented in these diverse schools. In order to overcome the obstacles concerning the implementation of ICT in such schools, they suggested intervention strategies and focused on the development of ICT implementation plans.

International studies have revealed that in order to realize the goal of developing ICT implementation plans, the formulation of an ICT policy for computer implementation is important. Dierkes, Hoffman and Mars (cited in Aune and Sørensen, 2002) suggest that policy formulation should not only include recommendations on the use of computers, but it should also include infrastructure development, workload distribution and the development of a vision on the importance of computers.

Nationally, a policy document has been developed by the South African Department of Education. This policy contains a framework concerning ICT implementation in education (South Africa, 2001). It states that over 70% of schools in South Africa are still without computers. In order to provide resources for schools to implement ICT, the

government needs to cooperate with both the public and the private sector to ensure that more schools are equipped with modern technology for the improvement of education in South Africa. This is to guarantee that our children are technologically equipped to compete in the global market (*ibid*).

On a provincial level, progress in computer implementation in schools in South Africa has been made through projects such as the Gauteng Online in Gauteng, the Khanya Project of the Western Cape, as well as the Northern Cape's Connectivity Project (South Africa, 2004). There are also other, smaller computer projects in some provinces in South Africa, which provide Internet connectivity to schools and are both government and privately funded. One of these projects in the Eastern Cape, called Connect Eastern Cape, is government-initiated. This community project was established to ensure the availability of the Internet to the wider community (ICT Projects Coordinator, Eastern Cape, 2004). However, there are other privately managed Tux Lab projects for Open Source software such as the Shuttleworth Foundation, the Project Champions and Ubuntu in Port Elizabeth (W. Haggard, personal communication, November 10, 2006).

In the Makana and Somerset East districts, a number of schools are equipped with computers. To find out how well schools have implemented computers, five schools in these districts were visited; one former Model C (FMC) school, two former House of Representatives (FHOR) schools, one independent school (IS) and one former Department of Education and Training (FDET) school. Specific attention was given to, amongst others, the schools' infrastructure; the implementation and maintenance costs of computers; the role of the computer coordinator; the role of parents, teachers, the government and the private sector in the implementation process; as well as the challenges encountered and achievements named by these schools with regard to the implementation of computers. The suggestions from these schools have been synthesized with the intention of informing an ICT policy for GDPS in Grahamstown. It is necessary to assess national and provincial ICT policies as well as local schools' implementation policies and practices to develop an ICT policy for GDPS. The suggestions from these documents and schools can help GDPS draw up a well-informed and comprehensive ICT policy for the school, which might help teachers and learners to utilize ICT extensively in the classroom. This ICT policy document for GDPS will be

developed after this research study has been concluded and the various stakeholders at GDPS have considered the suggestions.

1.3 Goals of the research

The main research question that framed this research project is:

- What does the ICT practice in five primary schools in the Makana and Somerset East Districts of the Eastern Cape suggest about the implementation of ICT in a local primary school?

The two subsidiary questions are:

- How do a selection of local schools in the Makana and Somerset East Districts implement ICT in their schools?

- How can these practices inform the computer implementation process at George Dickerson Primary School?

The focus of the thesis has not been on the ultimate ICT policy itself, but rather on the research process, including suggestions from other sources internationally, nationally, provincially and locally, to inform the formulation of a final policy for GDPS.

1.4 Research design

The method, a logical approach, used for this research is a case study within the interpretive paradigm (Cohen, Manion and Morrison, 2000), which, according to Cohen *et al*, is used "to understand the subjective world of human experience" (p.22). Furthermore, they write that within the interpretive paradigm, theory should be developed from the researcher's understanding and experience. This is imperative in this case study as I wanted to gain an in-depth understanding of the processes involved in computer implementation in schools.

The participants consisted of one government official from the Eastern Cape (EC) Education Department, as well as five ICT coordinators from five schools in the Makana and Somerset East Districts. These participants were chosen to obtain provincial government and schools' perspectives on ICT implementation in schools in

South Africa. Since this case study attempted to obtain information about ICT in schools in a specific district and other stakeholders in a specific province, the sampling method that was use in this research is the judgemental or purposive sampling method (Kumar, 1996). Kumar writes that within this method, the researcher is selective "as to who can provide the best information to achieve the objectives of the study" (1996: 162).

1.5 Research process

There were three phases in this study:

The first phase focused on printed and online government policies and documents regarding computer implementation in schools.

The second phase focused on an interview with one EC government official. Additionally, provincial government documents on ICT implementation were analyzed.

The third phase focused on interviews with five ICT coordinators from local schools in the Makana and Somerset East districts, in order to inquire about their computer implementation process, as well as to analyze their school's ICT policies, if they were available.

To analyze the data from the interviews, a coding frame (Wilkinson, 2000) was used. Wilkinson sees the coding frame as "a way of classifying data and drawing themes from it" (Wilkinson, 2000:79). The documents were analyzed through a "comparative analysis" where different documents were compared with each other to develop an understanding of the content of these documents (Blaxter, Hughes and Tight, 1996:187).

1.6 Overview of the research chapters

The subsequent chapters provide a brief overview on ICT implementation in schools internationally and nationally.

Chapter two reviews the literature in order to develop a critical perspective on the importance of computers in schools. Specific attention was given to how computers are used in schools internationally and nationally. The importance of ICT policy for schools is also discussed.

Chapter three discusses the research methodology that was used in the research project. Of specific interest is the qualitative data that was used in the research.

Chapter four discusses the findings of the research, which will be used to inform the development of an ICT policy for GDPS. The chapter focuses on the process of data analysis and the researcher's subjective interpretation of the qualitative data that was collected.

Chapter five presents a summary of the findings, the limitations of the study, as well as recommendations for further research.

Chapter 2

2 Literature Review

2.1 Introduction

Information Communication Technology (ICT) has already played and will in all probability continue to play an important role in all spheres of society in the future. ICTs are already extensively used in banking, commerce, agriculture, government, and education. These are the economic sectors that will in future employ many school leavers. Cook and Finlayson (1999) argue that without ICT skills and knowledge, many young adults may lose out. It is therefore vital to look at the role of ICT in education, and more specifically in schools.

This chapter endeavours to explain the rationale behind the use of ICT in education, particularly in schools. First of all, a brief account of the role of ICT in education in general is provided. This is followed by a more detailed explanation of the implementation of ICT in schools. The use of ICT in schools for administration, for teaching and for learning in particular, is also discussed in this chapter. In addition, two leading approaches to learning, the traditional (behaviourist) and the constructivist learning styles, as well as their implications for teaching and learning, are examined.

Finally, a selection of ICT policies in education from the rest of the world, most notably in Asian and European countries, is reviewed. This is followed by a discussion of the ICT policies of a few African countries. In conclusion, the ICT policies in four provinces in South Africa are examined.

2.2 ICT in education

ICT's increasingly substantial role in the modern world is most visible in the commerce, banking and the media sectors, to name a few. Cook and Finlayson (1999) note that with the rapid advancement of technology in the modern world it is important to be acquainted with the use of ICT. From their perspective, access to ICT will determine who will be part of the world of technology in the future. The educational issue we need to address is: are

we adequately preparing students for this world? This is especially important in the light of increased criticisms that suggest ICT in schools has not significantly contributed to pupils' scholastic improvement (Hokanson and Hooper, 2000).

However, there are two major views regarding the use of ICT in education and its implications for society, which can be classified as the optimistic and pessimistic views (Howell and Lundall, 2000; Polikanov and Abramova, 2003; Selwyn, Gorard and Williams, 2001). The optimistic view embraces the use of ICT in education. Howell and Lundall (2000) mention two kinds of optimists – the inevitablilists and the euphoric or visionary optimists. The inevitabilists maintain that ICTs are a significant part of everyday life and that one should be acquainted with them. Furthermore, ICTs should be an important part of the school curriculum in order to prepare learners for the modern world of technology (Howell and Lundall, 2000). The euphoric and visionary optimists, on the other hand, maintain that ICTs, which are increasingly found in the economy, may change the way we live, communicate and work (Howell and Lundall, 2000).

In contrast, the pessimists' view is that ICTs epitomize the already huge digital divide that exists between the developed and the developing world (Howell and Lundall, 2000; Polikanov and Abramova, 2003; Cuban, 2001). Not only do they maintain a pessimistic view in terms of the digital divide, but also in terms of how ICT is taught in the classroom. Stoll warns that computers encourage students to hand in "hypermedia projects" instead of written assignments (1999:6). He further cautions that simply downloading any material from the Internet does not mean that the student has learnt anything. From personal experience at my school when I gave the seventh grade classes a project to do, one of the students simply downloaded the information from the Internet without even reading the content, and handed me the copied pages.

Many governments seem to embrace the optimistic view, by encouraging the implementation of more and more computers into schools, believing that this medium will change pupils and society for the better (Mooij and Smeets, 2001). But, are computers skills enough to prepare students for the information age, and how important are computers in schools in the information age?

2.3 The importance of computers in schools

Although computers are seen as essential in the world today, the significance of computers in schools needs to be examined. As noted by Hokanson and Hooper: "Despite a history of achieving only marginal benefits from using technology in education, many schools and other educational organizations are investing heavily in computer technology" (2000:537). Even though there are challenges and doubts surrounding the implementation of ICT in schools, in my opinion, computers are seen by many as important because of their continued implementation in schools. I agree with Chapman's argument concerning the importance of computers in a child's education:

> Computers are transforming communications and the economy, and every child should be exposed to this technology to understand the significance of this technology. Every high school graduate should know how to use a computer and the Internet, understand how a computer works, have some grasp of how to find information on the Internet, and generally know how computers are used by the businesses, the government, educational institutions and people in their homes. At a bare minimum, students should know how to type, how to use a word processor, how to "drive" an operating system and how to navigate the Internet (Chapman, 1998:64-65).

Hawkridge, Jaworski and McMahon (1990:17) discuss four reasons why computers should be used in schools. The first two of these rationales deal with preparing learners for an industrialized world. These are the *social rationale*, according to which learners are trained to become computer literate, which prepares them for participation in a computer-rich world. In what they call the *vocational rationale*, Hawkridge *et al.* (1990) advocate that computer training should prepare students for their future jobs. The last two rationales deal with computer implementation in the classroom. The *pedagogical rationale* sees computers as integrated into the curriculum so that teaching and learning can be enhanced. The *catalytic rationale* sees the learner becoming independent from the teacher in using computers.

There are many reasons why ICT is seen as important in schools, but here I will focus on two of them. This refers to the rationales mentioned above by Hawkridge *et al.* in which the first two and the last two rationales are combined:

To prepare pupils for the future in an industrialized society: this relates to the social and vocational rationales of Hawkridge *et al*. In order to prepare pupils for the "information age", governments across the world spend huge amounts of money on the implementation of ICT in schools (Pelgrum, 2001). ICT policies are drawn up, schools are supplied with computer hardware and software, and Internet connectivity is provided to schools (*ibid*.). This is still evident today, where governments monitor the implementation of ICTs in schools on a regular basis in order to enhance ICTs in their schools (Pelgrum, 2001). So why do governments spend such enormous amounts on computers in schools? It is often assumed that ICT, especially computers in schools, will lead to pupils being more productive future workers in the 'information age' (Leask and Meadows 2000; Pelgrum 2001). Cuban writes:

> The economic prosperity of the 1990s … has now convinced most doubters that information technologies have accelerated American workers' productivity. As a consequence, introducing electronic tools into schools has become a priority of corporate leaders and public officials (2001: 13).

As a mechanism for learning and teaching: this refers to the pedagogical and catalytic rationales suggested by Hawkridge *et al*. (1990). In order to equip pupils with the technological skills to make a significant contribution in an ICT rich world, careful consideration should be given to how to integrate computers into teaching and learning. The White Paper on e-Education (DoE, 2004*:*14) in South Africa claims: "ICTs can advance high order thinking skills such as comprehension, reasoning, problem-solving and creative thinking and enhance employability." Wakefield (1996*:*408) defines higher-order thinking skills as "relatively complex cognitive performances, the ultimate purpose of which is not efficient use of memory but problem solving". These cognitive performances can include critical thinking (evaluative skills, broadly defined); problem solving (finding and solving a problem through analysis, synthesis and evaluation); metacognition (an awareness of one's own thought processes and the skills used in these thought processes) (Wakefield, 1996*:*410).

2.4 The uses of computers in schools

Stevenson (1997:13) provides a few examples of how computers may be used in schools:

- to administer schools;
- to train students in skills which they will need in further education and ongoing learning throughout the rest of their lives and for their future jobs, e.g. word processing, computer programming, etc.;
- to provide access to information and communication outside the classroom walls, e.g. video conferencing with students in other countries, using the internet, etc.;
- to support teacher development, e.g. through external networks;
- to support and potentially transform the learning/teaching process in many and diverse ways.

I have grouped the uses of computers in schools into further categories (Figure 2.1), with a short explanation of each: administration, communication, teaching and learning, research, marketing, outreach programmes and entertainment.

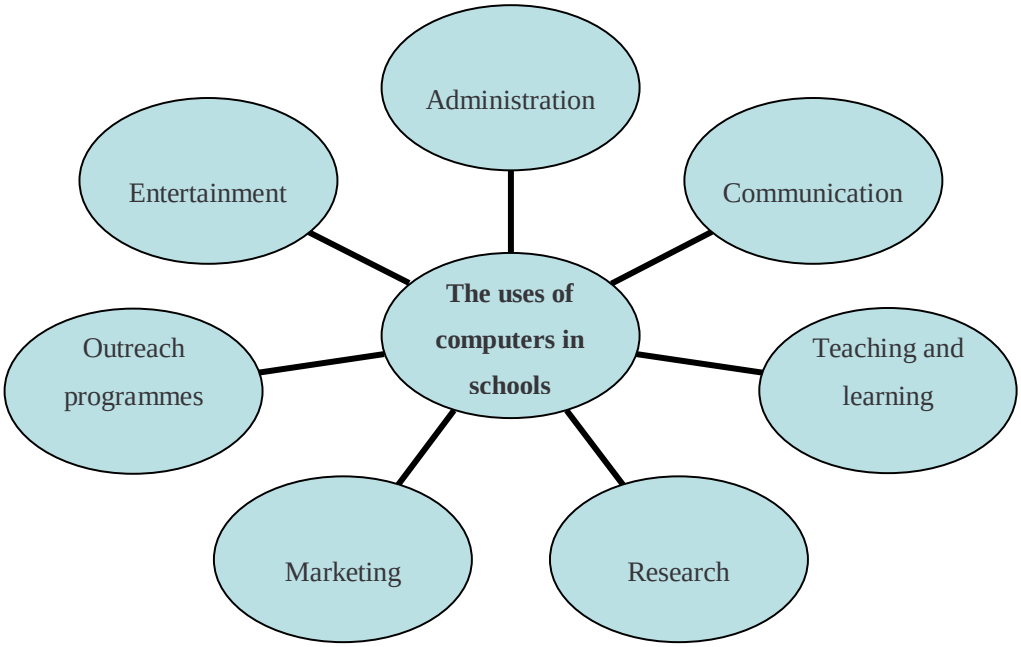


Figure 2.1: The uses of computers in schools

Administration. Administrative, managerial and teaching staff members use computers for administrative purposes. Examples of using computers for administration include typing and printing of official documents, lesson plans and worksheets; designing and typing other documents (e.g. school reports, timetables, tests); creating a database of teachers and pupils; creating spreadsheets for maintaining the school budget; and for keeping records of assessments. If Internet connectivity is available, computers can be used for reading and responding to official e-mail messages and for creating and maintaining the official school website. Many teachers use computers, either their own computers at home or the school's computers, mainly for administrative purposes.

Communication. The Internet is a very effective mechanism to communicate by using applications such as electronic mail (e-mail) as a supplement to teaching in the classroom (Hassini, 2004) and Internet Relay Chat (IRC). When people communicate with each other via the Internet, it is called Computer-Mediated Communication (CMC) (Lamb and Smith, 1999:23). These applications can also be used effectively in the ICT classroom. For example, learners can communicate with each other through an interactive website called *e-pals* (http://www.epals.com/). Here they can exchange ideas about their own culture, complete projects, and talk to teachers from all over the world.

Teaching and learning. The introduction of ICTs into the classroom has the potential to transform many people's traditional way of thinking about education (Kennewell, 2004). According to Kennewell, education is no longer seen as the teacher transmitting knowledge to the pupils. Computers in the classroom may have played a role in changing this view (*ibid.*). Cuban (2001) also supports this view, and says many professionals believe that computers are replacing conventional teaching practices. Although Cuban's view is in my opinion overstated, it is worth considering. For example, although computers may advance higher-order thinking (DoE, 2004), the role of the teacher in the classroom is indispensable. This point will be discussed later in this chapter.

Research. The Internet remains an effective electronic research mechanism that students can employ to undertake in-depth research. However, conducting Internet research is more than just 'surfing' the Internet for information. Effective Internet research tools and methods need to be employed before reliable research can be done. Teachers and learners need to be familiar with and knowledgeable about different tools and methods that can be employed. A few examples of different Internet research tools are directories, search engines, e-mail directories, newsgroups, listservs, software search tools, File Transfer Protocol (FTP), search tools and metasearch engines (Morrison, Lowther and DeMeulle, 1999).

Marketing. An effective way to market the school is through the school website, created and maintained by dedicated teachers, pupils or parents of the school. Wells (2001) suggests that the ICT policies and processes will be upheld and ICT progression will be significant in the curriculum if an exceptional website is developed. The main priority for a school's website, therefore, is to disseminate information about school activities, courses, location of the school, staff and pupils, and so on. If the school has Internet connectivity, pupils may use the Internet to share information with other pupils around the world (Turyagyenda, 2003), thus also marketing the school in an indirect way.

Outreach programmes. Many schools with computer laboratories and Internet connectivity make use of, or are encouraged to make use of, outreach programmes as a further strategy to market the school and support the local community. For example, schools can promote the use of the computer laboratory to interested members of the public to teach computer skills. Computer-skilled teachers can act as instructors. In this

way the school can generate much-needed income to help fund the costs of maintaining the computer laboratory. This strategy is clearly encouraged by the South African Department of Education:

> Government will support community access to e-schools. The objective will be to increase opportunities for communities to use e-school resources, develop their computer and Internet skills, and take advantage of services offered through ICTs. In return the community will support the sustainability of ICTs in the e-school (DoE, 2004:32).

Entertainment. Taylor (1980) refers to the use of computers in this way as a 'toy'. In addition to all the other uses, computers are also used for playing games, be it for educational or for leisure purposes. Depending on the type of software that is used, games can be interactive, communicative or thought-provoking (Klopfer, 2005). Even for very young learners, mathematical skills and language can be enhanced through the use of mathematical games. Furthermore, Klopfer maintains that learners' cognitive and motor skills can be improved by interaction with each other through playing games.

2.5 ICT in the traditionalist (or behaviourist) and constructivist classroom

In order to understand how ICT is used for teaching and learning, the use of ICT in a traditional classroom setting vis-à-vis the use of ICT in a constructivist classroom setting will be explored. The discussion will focus on the role of the teacher, how learning occurs, as well as what software is often used in these two contrasting classroom practices.

The role of the teacher in transforming (or opposing change in) learning and teaching in the classroom cannot be over-emphasized. Two primary approaches to teaching in the classroom, the traditionalist approach and the constructivist approach, derive from teachers' beliefs and theories of what learning and teaching constitutes (Cloke and Sharif, 2001).

2.6 The traditionalist approach

The traditionalist approach to learning sees the role of the teacher as central in the teaching process. In this view the teacher is the most knowledgeable person in the class and is the sole transmitter of knowledge. On the other hand, the learner, who is less knowledgeable, is the passive receiver of knowledge. This is what is often referred to as

the ‘jug and mug’ approach. In other words, it is assumed that the learner assimilates complete information from a more knowledgeable person, the teacher (Bodner, Klobuchar and Geelan, 2001). Schömmer (cited in Howard, McGee, Schwartz and Purcell 2000, 455-456) sees the traditional teacher (who holds naïve epistemologies, in Schömmer’s view) as someone who:

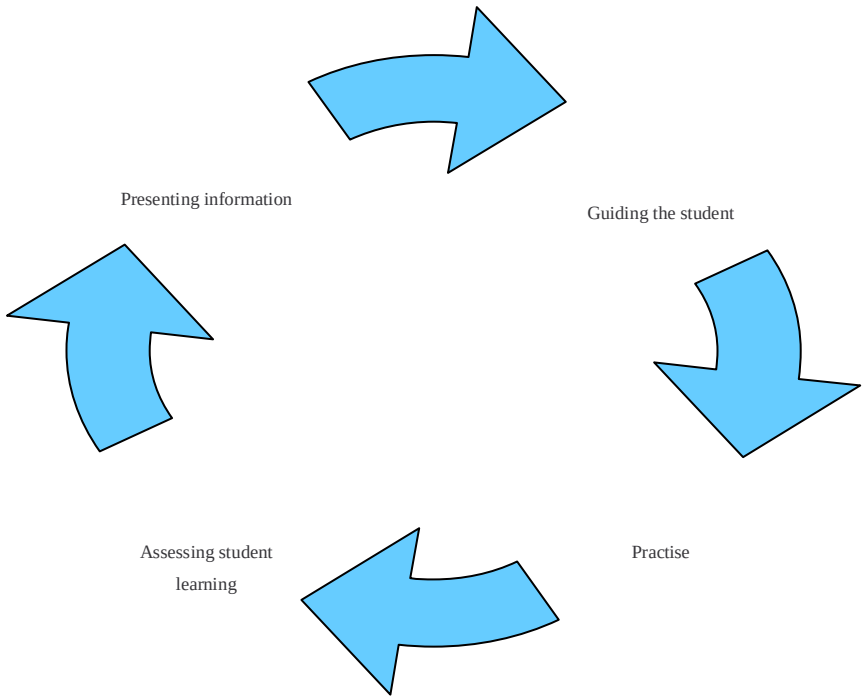
> generally believes that knowledge (1) resides in authorities and is thus unchanging, (2) concepts are learned quickly or not at all, (3) learning ability is innate, and (4) knowledge is simple, clear, and specific.

Pachler illustrates the learning process that takes place in a traditionalist environment in the ICT classroom:

> In ICT terms, applications in the behaviourist tradition tend to follow an instructional pattern. Learning is broken down into a sequential series of small steps, each covering a piece of the subject domain or a particular skill. The computer program models the role of the tutor offering some input or paradigm that the learner can ‘drill and practise’ followed by the provision of the feedback (1999:8).

The instruction-based practice is evident in Alessi and Trollip’s (1991:6-10) view regarding computer-based instruction (CBI). According to them, an instructional model will only be successful if the following phases are included: presenting information, guiding the learner, allowing the learner to practice as well as assessing learner learning (see Fig. 2.2).

Figure 2.2: Computer-based instruction (CBI)



(Adapted from Alessi and Trollip's (1991:6-10) instructional model.)

Presenting information: The instructor carries out the task first in order for the student to repeat the exact steps. This is instructor-centred.

Guiding the student: The student performs the instruction according to the instructor's example, and the instructor then guides and corrects the student if he or she is wrong. This is both instructor- and student-centered.

Practice: The instructor only intervenes when necessary, while the student practises on his/her own. This is entirely student-centered.

Assessing student learning: In order to establish whether possible instruction is needed in the future, the student is tested to determine the quality of teaching (Allessi and Trollip, 1991).

This model is clearly linear: it is structured in such a way that it has a starting point and an ending. Starting from a given point, progression usually follows from the beginning to the end without omitting a step. As such, this model reveals its behaviouristic underpinnings. Alessi and Trollip (1991) recommend that this model is also suitable for

CBI. They identify five major types of CBI: tutorials, drills, simulations, games and tests. In terms of computer practice, they maintain that this model is appropriate for teaching computer skills such as learning how to use a word processing program or manipulating the computer (Alessi and Trollip, 1991). It is an ongoing process, because it involves the teacher assessing the student's lack of appropriate skills, and the teacher rectifying these limitations by starting the process all over again. The role of the teacher, as the transmitter of knowledge, is fundamental. Although the teacher's role is significant in the learning process, appropriate software also plays a vital role in the learning process.

Computer software packages may seem sufficient for teaching and learning in an educational environment, but one needs to scrutinize these packages carefully. It is necessary to observe the software developers' beliefs and theories of learning that underpin the design of these software packages when assessing these packages (Squires and McDougall, 1994), especially in the light of one's own practices in the classroom.

Squires and Mcdougall (1994) divide the theory of learning underpinning each software package into two broad categories: behaviourism and constructivism.

> Behaviourist learning materials provide fixed instructional sequences, with each step in the sequence based on the acquisition of a limited piece of knowledge and understanding. Computer based drills are the classic manifestation of the behaviourist approach to educational software design (Squires and McDougall, 1994*:*88).

Blease (1986) believes that traditional practices in teaching and learning in which repetitive instruction is the norm is appropriate in the design of behaviourist software. Likewise, Bonnett (1997) notes that, in its simplest form, this type of software provides an instructional format, whereby the pupil does the task, and after responding to the computer's feedback, moves on to another task if he/she has successfully completed the task at hand.

Depending on the teacher's outcome, my belief is that this approach might still have relevance in a contemporary classroom.

2.7 The constructivist approach

The constructivist approach contrasts with the traditional approach. Constructivists generally believe that the learner constructs his/her own knowledge. In other words, "knowledge is constructed in the mind of the learner" (Bodner *et al*., 2001). The role of the teacher is to facilitate the learning process. This means that the teacher arranges the conditions in which learning is to take place, and acts in a supportive role towards the learner (Kennewell, 2004). The teacher therefore has a significant role to play, as outlined by Loveless:

> It is by knowing when and how to intervene to encourage pupil autonomy and contributions that influence the quality of the learning experience for both child and teacher. Knowing when to stand back in order to allow children time to work through uncertainty to solutions; knowing when to provide new information and skills to equip the children in their tasks; knowing when to ask a question to challenge or divert; knowing how to balance guidance and sharing of expertise with providing opportunities for children to think and work things out for themselves – such knowledge implies intelligent action that lies at the heart of effective teaching skills, and which reflective teachers develop throughout their teaching careers (Loveless 1995, cited in Loveless, DeVoogd and Bohlin, 2001*:*68–69).

Schömmer (cited in Howard, McGee, Schwartz and Purcell 2000) sees the constructivist teacher as someone who believes that knowledge is abstract, logical and learner-centered. Similarly, Moll (2002) defines the learning process in a constructivist paradigm as follows:

> Learning is an active process involving the learners constructing meaning for them. The process requires the application of knowledge, skills and values. It is a problem solving approach, which leads to "new" knowledge for the individual. The basis for the approach is discovery learning: new knowledge comes from reconstruction by discovery (2002*:*9).

According to Duffy and Cunningham (1996:71) there is a widely accepted notion of what constructivism implies: "(1) learning is an active process of constructing rather than acquiring knowledge, and (2) instruction is a process of supporting that construction rather than communicating knowledge". They state further that, in contrast to behaviourism that focuses on the end product, constructivists focus on the whole activity rather than the end product.

Computer software applications can reflect constructivist theories. Squires and McDougall (1994) note that students' own methods of learning are encouraged through constructivist applications. In essence, it is not so much about what specific program the end user uses, but how these programs can be applied to reflect constructivist principles. In fact, a simple word processing program can be applied in a constructivist classroom by encouraging exploratory, enquiry-based learning (Brown, 1996). Simple tasks and assignments that learners usually do in a word processing program on a computer can be applied through a constructivist approach.

Other software programs that can be used similarly include spreadsheets, databases, and simple web development programs. These software programs can be divided into categories. Squires and McDougall (1994) identify two commonly used types of software: content-free and subject-specific. In content-free or generic software, word processors and spreadsheets are handled to carry out the tasks that the user wants the computer to carry out, for example, typing out documents, managing a database and performing calculations. Subject-specific software packages specifically pertain to the pedagogy and focus on specific subjects or topics (Squires and McDougall, 1994). Although not evident in their discussion, these packages can also be used in a constructivist environment, depending on the task at hand.

2.8 Factors that influence the use of computers in schools

The rapid implementation of ICT in schools worldwide gives rise to another important question: what are the factors that influence the use of computers in schools? It seems that there are a number of factors that influence the use of computers in schools. Some of these factors include the number of computers in the school, whether or not a school has Internet connectivity, and whether or not teachers are trained effectively in ICT (Figure 2.3).

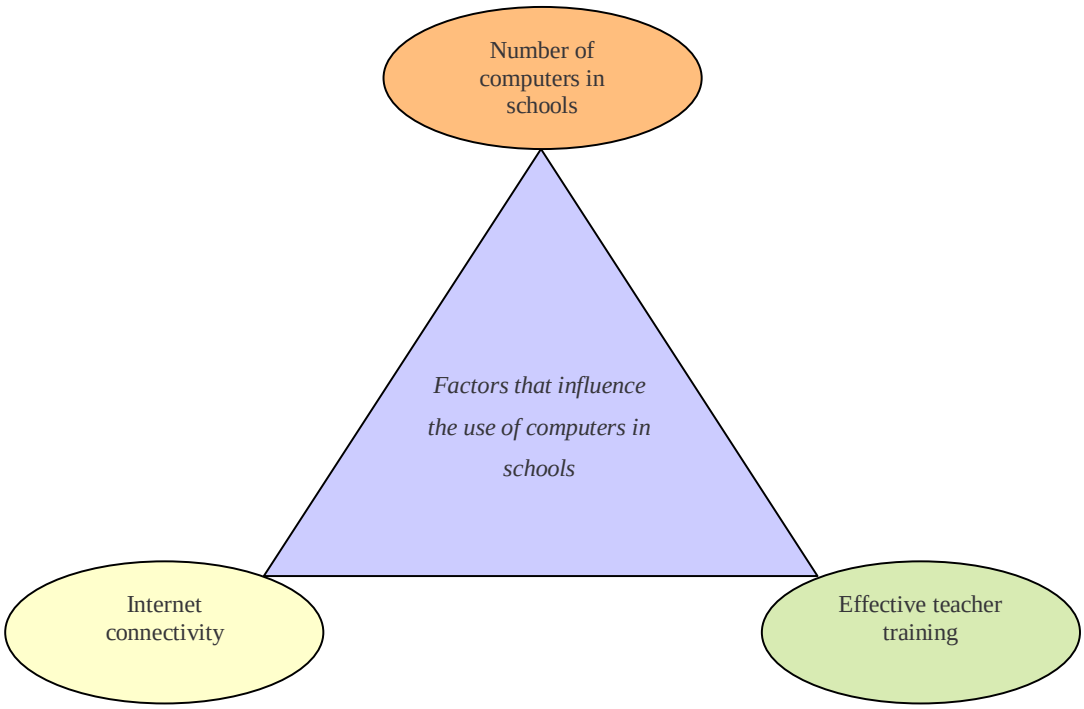


Figure 2.3: Factors that influence the use of computers in schools

The number of computers in schools. This factor depends on the availability of computers at a school with or without a computer room. This could determine whether computers are used for teaching and learning, or whether computers are used for administrative purposes. In the Second Information Technology in Education Study (SITES), conducted in 1997-1999 and involving 26 countries, it was found that an insufficient number of computers in schools was the main reason for not realizing a school's computer-related goals (Pelgrum, 2001:173).

Internet connectivity. This factor is determined by the availability of computers in schools. The White Paper on e-Education (DoE, 2004) states that due to the high cost of Internet connectivity and telecommunication, it is not always possible for schools, especially poor schools, to make use of the Internet for teaching and learning.

The move to equip schools with ICT and Internet connectivity is mainly initiated by governments internationally. In some cases, the private sector, in collaboration with the government as well as educational institutions and members of the school community, also contributes to the implementation of computers in schools.

Effective teacher training. It is important that proper teacher training in ICT and computer use be a prerequisite in schools if successful implementation of ICT into the curriculum is to be achieved. The problem is that untrained or inadequately trained teachers might be disinterested and may therefore develop a resistance to using the computers in the classroom (Anderson, 2002). McFarlane emphasizes that:

> teachers who are uncomfortable with computers, and who fail to see how they can be used to enhance learning, simply do not use them. One-day awareness courses are clearly inadequate to address this huge skill gap, yet this is the most commonly experienced form of in-service training (1997:177-178).

These training programs usually emphasize computer skills training, rather than using the computer to enhance teaching and learning.

2.9 ICT in education in South Africa and the rest of the world

Howie, Paterson and Muller (2005) point out that many developed countries have implemented ICT successfully into schools for teaching and learning, and argue that, owing to the cost of implementing ICT into education, many developing countries have fallen behind with the implementation process. In this section, I take this into account as I discuss crucial concepts regarding computer implementation in education. First of all, I will provide a brief discussion on the importance of the development of ICT polices, followed by a discussion on the so-called "digital divide". I will then analyze three ICT policies in First-World countries in Europe and two ICT policies in Third-World countries in Africa. Finally, I will discuss ICT in the South African education system, followed by a discussion of the ICT policies of four provinces in South Africa, focusing on the Eastern Cape.

ICT policies: Most governments around the world see the development of ICT policies as indispensable to the successful integration of ICT in education. Kozma and Anderson state:

> Countries from Chile to Finland and from Singapore to the United States have all set national goals and policies that identify a significant role for information and communication technologies (ICT) in improving their education systems and reforming their curricula. Major investments have been made to increase the numbers of computers in schools and the networking of classrooms (2002:387).

While governments do all they can to initiate computer implementation in schools, it is the poorer countries who have lagged behind in the computer implementation process.

***The digital divide*:** Although ICT in education is seen as significant in many aspects in a computer-rich world, there is still a huge gap regarding implementation of computers in schools between rich and poorer countries. This is what is known as the 'digital divide' (DoE, 2004; Selwyn, Gorard and Williams, 2001), Selwyn, Gorard and Williams describe the 'digital divide' as "a growing disparity between those individuals and communities that have and those that do not have easy access to new information technologies" (2001:261). The digital divide is more evident in the implementation rate of computers in schools.

While many developed countries have had a 90 – 100% computer implementation success rate, developing countries have had less success with the implementation of computers in its schools. Table 2.1 illustrates the computer/student ratio and Internet connectivity in some developed and developing countries in Asia and Europe between 1999 and 2004.

Table 2.1: The computer/students ratio and Internet connectivity in developed and developing countries

Year	Country	Internet connectivity in schools	Computer/pupil ratio
2004	UK	100%	1: 7.5 (primary)
1999	Finland		1: 12
1999	Italy		1: 28.5
1999	Portugal		1: 150
2002	Canada	+ 80%	1: 9
2002	South Korea	100%	1: 9

The computer/students ratio and Internet connectivity in developed and developing countries: The above table shows that the United Kingdom (UK) have 99% of all schools connected to the Internet, according to the Statistical First Release, ICT of 2002 (UK, Department for Education and Skills, 2004). In many primary schools in the UK there were 7.5 pupils for every computer in 2004, while high schools had 4.9 pupils for every computer in 2004 (UK, Department for Education and Skills, 2004). According to a report in 1999 by the European Schoolnet, Finland has a ratio of one computer for every 12 students, while Italy has a ratio of one computer for every 28.5 pupils. Portugal has a ratio of one computer for every 150 pupils (Abbott, 2001:109-110). The high computer/pupil ratio in Canada is similar to many European schools. The report by the Second International Technology in Education Study, Module 2 (SITESM2), says that one computer was available for every nine pupils in elementary schools in Canada in 1999 (Granger, Morbey, Lotherington, Owston and Wideman, 2002). This report further mentions that over 80% of schools in Canada had Internet connectivity in that year. In Denmark, the number of computers with Internet connection, from the total number of computers used for teaching and learning in 2002 was 82,2%; in Sweden 80,4%,; and in both Finland and Iceland 75,3% (Hylén, 2003).

Many of these schools enjoy extensive support by their governments to successfully implement computers and ICT into their classrooms. In European countries, many of these governments have set targets to elevate their pupil/computer ratio in schools (Abbott, 2001:109-110). For example, Denmark set a target to raise computer/student ratio in primary schools by between 1:5 and 1:10 by the year 2003. In 2003, the Portuguese government, which has one of the largest computer/pupil ratio in Europe, set a computer/students ratio target of "1:25 in primary schools, 1:20 in secondary schools, and 1:10 at all levels by 2006" (Abbott, 2001:10). South Korea has 100% Internet connectivity in its schools with a computer/student ratio of 1:9.

2.10 ICT policies in education

2.10.1 The United Kingdom

In 1998, the British Government initiated the establishment of the National Grid for Learning (NGfL) (UK, Department for Education and Skills, 2004; Selwyn, 1999; Selwyn and Fitz, 2001; Dawes, 1999) to integrate ICT resources in institutions. Its aim was to contribute to the extensive use of ICT and the Internet across the country (Selwyn, 1999). The British Prime Minister promised that by 2002 the process of implementing computers and the Internet, as well as the training of adequate teachers in the use of the computers would be completed (Dawes, 1999). Huge amounts of money were invested in the implementation of the grid. It was estimated that the government has pledged 700 million pounds and a further 230 million pounds in lottery money to connect every school to the Internet (Selwyn, 1999). The government's motivation for investing such large sums in ICT is, in my opinion, the apparent optimistic view that ICT in schools will be beneficial to an ICT-infused economy. The findings of an independent committee, the Stevenson Committee, were that the non-integration of ICT into schools in the UK would not be advantageous to the people (Dawes, 1999). The grid has also been closely linked to the private sector for its implementation success. Selwyn notes: "Large firms such as British Telecom, Research Machines, ICL, Exemplar and Microsoft soon positioned themselves alongside the government as major players in establishing the grid" (Selwyn, 1999:64). The aims of the NGfL are outlined below:

- Connecting all schools to the NGfL via the Internet;
- Ensuring that all serving teachers are confident and competent to teach using ICT within the curriculum;
- Phasing out the need for most paper-based administrative communications between educational institutions;
- Ensuring that DfEE communications with the education service are mainly electronic;

- Making Britain a centre of excellence in the field of digital learning.

(UK, Department for Education and Skills, 2000).

This initiative explains why the UK is among the leading countries in the world regarding computer implementation and Internet connectivity in its schools.

2.10.2 The Netherlands

The Dutch government formulated a computer policy in the mid-eighties to implement computers in its schools. They have done this through a plan called the Informatics Stimulation Plan (INSP), which ran from 1994 – 1998 (Brummelhuis and Plomp, 1994). This plan had two main aims: to introduce computer literacy as a subject and to enhance teaching and learning through the new technology, computers (Brummelhuis and Plomp, 1994). This plan built on previous initiatives such as the New Information Technology in Secondary Education (NIVO) project which was "a collaborative effort of government, business and the educational umbrella organizations to provide hardware, courseware and in-service training on a large scale" (Ministry of Education, 1985b; NIVO, 1987 in Brummelhuis, 1995:32). To ensure implementation of the programme, the government decided to implement follow-up projects. One of them was the PRINT project, whose aim was to provide support to schools, as well as implementation of hardware to schools (Brummelhuis and Plomp, 1994). Another project was OPSTAP (the word meaning 'moving on'). "The OPSTAP policy was aimed at finalizing the process of initiation and implementation of information technology in education" (Brummelhuis, 1995:34). This plan not only highlights the implementation of Internet connectivity to all schools in the Netherlands, but also promises to uplift the teachers' standards in the use of ICT in schools, as well as to ensure that the government itself is connected to the Internet to enhance electronic communications via all its departments. These projects elicit the government's optimistic view regarding ICT in education.

2.10.3 Norway

In contrast to Britain and the Netherlands, the Norwegian government does not initiate computer implementation in schools. Rather, the focus has shifted from the central government to the local government, and to the schools themselves (Aune and

Sørensen, 2002). "Central government may set standards and objectives, and they may even call for quite distinct didactic changes. However, the decision to buy computers resides with local authorities and the individual school" (Anne and Sørensen 2002:164). Although the shift has moved from the educational value of computers to being computer competent and skills orientated (Aune and Sørensen, 2002), the Norwegian ICT policy aims to encourage equal opportunity in computer skills and ICT (Aune and Sørensen, 2002). Various ICT plans have been drawn up over the years to facilitate ICT in education. The Norwegian policy, entitled the ICT in Norwegian Action Plan for 2000 – 2003, aims to:

- Increase emphasis on the pedagogical use of ICT (i.e. on forms of work, organization and assessment, as well as ICT as a tool in such a development);
- Continue emphasis on the development of teachers' expertise – especially in respect of the pedagogical application of ICT in initial and continuing education and training;
- Encourage new ICT possibilities and adaptation of ICT for the physically handicapped;
- Address the needs of the private and public sectors and individuals for general skills and top-level expertise in ICT, how it affects the subjects in general and the impact ICT has on determining the content of education and the offers of education made available;
- Continue emphasis on girls/women and ICT, and how training is given, in order to avoid disparities between the sexes and to promote the recruitment of women to science subjects and ICT subjects;
- Maintain the current distribution of responsibilities in respect of the acquisition of hardware, software and infrastructure and, by means of state initiatives, promoting cheap and good offers of infrastructure (Norway, Norwegian Education Department, 2000: 9).

This policy is distinctive in that it is inclusive of all members of society, especially the physically handicapped and women in science education. This policy also emphasizes

the government's optimistic view regarding the importance of ICT in a technologically demanding world.

2.10.4 ICT in developing countries in Asia

In Asian countries, the digital divide seems as pervasive as the vastness of the continent (Borja, 2004). This is evident in China's technological cities such as Beijing and Shanghai, where computers and Internet connectivity are available to many school pupils, while China's rural west has a scarcity of this technology (Borja, 2004). Figures released by the World Bank in 2001, according to Borja, indicate that China has 19 computers for every 1000 people; Singapore has 508 computers per 1000 people; 349 per 1000 in Japan; and 126 per 1000 in Malaysia. In South Korea, all primary and secondary schools had Internet access by 2002. South Korea also had among the lowest students per computer ratios in Asia, with one computer for every nine pupils.

Many Asian countries have adopted master plans to assist with the implementation of computers in schools (Borja, 2004). According to Borja (2004), countries such as South Korea and Taiwan have initiated expanded plans to implement computers in its schools. In Japan the Department of Education liaises with the private sector, to achieve this. India has started with a National Plan to introduce computer literacy programs and teacher training in more than 10 000 schools (Borja, 2004). Computers are not integrated into the curriculum, but are rather taught as a stand-alone subject in India, according to the United Nations Educational, Scientific and Cultural Organization (UNESCO) (Borja, 2004).

Teacher training in computer literacy is essential for the successful implementation and integration of computers into the curriculum. Mooij and Smeets note:

> If teachers are not confident in their ability or competence to handle computers this may hamper their willingness to introduce technology in their classroom. Lack of knowledge on the teacher's part may constitute a serious obstacle to the integration of ICT in … schools (2001:266).

For this reason, South Korea, Singapore and Taiwan have included teacher training in their master plans as a means to support computer integration in their schools. India has also initiated teacher training in the use of technology in its "technology action plan". But in Japan, teacher training in technology is not required (Borja, 2004).

These countries have gone to great lengths to introduce, expand and implement ICT into their school curriculum, but more needs to be done in developing countries regarding ICT implementation in schools. These should include efforts by governments to narrow the computer/pupil ratio, reduce the uneven spread of computers, and ensure that teachers are properly trained in computers so that successful implementation of ICT in schools and the school curriculum is realized.

2.10.5 Africa

Although Internet access in Africa is among the lowest in the world, ICT in Africa is rapidly increasing (Polikanov and Abramova, 2003). According to Polikanov and Abramova, many African states now have Internet access (2003), with South Africa the leader in this regard in southern Africa. They state: "The majority of Internet users in Africa are rich males, who speak English or any other Western language and live in the cities" (Polikanov and Abramova, 2003: 43). However, many African countries still do not have adequate Internet connectivity due to a lack of infrastructure (Kawooya, 2004; Polikanov and Abramova, 2003). This inadequacy in ICT infrastructure and connectivity reflects the pessimists' idea (Polikanov and Abramova, 2003; Howell and Lundall, 2000) that ICT will broaden the divisions that exist in the so-called 'digital divide' (Warschauer, Knobel and Stone, 2004; Looker and Thiessen, 2003) between the rich and the poor nations.

ICT policies are yet to be developed by governments in Africa to ensure successful integration of ICT in all spheres of society, especially in education (Kawooya, 2004). This also explains why it was very difficult to find ICT policies of African countries on the Internet. However, in the following section, I will briefly discuss the ICT policies of the few African countries that have ICT policies in place. These countries are Ghana, Namibia and South Africa.

2.10.6 Ghana

The government and the private sector have undertaken a number of initiatives to install ICT-infrastructure in Ghana in order to bridge the digital divide between Ghana and First-World countries (Intsiful, Okyere and Osae, 2003). In 2003, the Ghanaian government published the policy document 'The Ghana ICT for accelerated

development, or ICT4AD' (Republic of Ghana, 2003). This document "sets out the road map for the development of Ghana's information society and economy…" (Republic of Ghana, 2003:6). According to this document, its educational aim, amongst others, is to enhance learning and teaching through ICT in all spheres of the education system in Ghana.

2.10.7 Namibia

In 1995, the National Institute for Educational Development (NIED), initiated by the Ministry of Basic Education, developed a policy for ICT in Education. This policy, which was revised in 2000, also embraces the 'inevitabilist view' concerning ICT. Its aim is to prepare all ICT skilled students, learners and teachers in Namibia for the economic sector.

The overall goals of the policy are to:

- Produce ICT literate citizens;
- Produce people capable of working and participating in the new economies and societies arising from ICT and related developments;
- Leverage ICT to assist and facilitate learning for the benefit of all learners and teachers across the curriculum;
- Improve the efficiency of educational administration and management at every level from the classroom, school library, through the school and on to the sector as a whole;
- Broaden access to quality educational services for learners at all levels of the education system; and to
- Set specific criteria and targets to help classify and categorize the different development levels of using ICT in education.

(Namibia, Ministry of Basic Education, Sports and Culture and Ministry of Higher Education, Training and Employment creation, 2004:20).

Its specific educational goals are to equip students, learners and teachers with ICT knowledge and skills. This is done by concentrating on the pedagogical use of ICT within the classroom through five development levels, which students and learners must attain to enter the workforce. The policy aims to establish partnerships with NGOs, commerce, international bodies and civil society in order to fund its initiatives (Namibia, Ministry of Basic Education, Sports and Culture and Ministry of Higher Education, Training and Employment creation, 2004).

2.10.8 South Africa

As in many other countries in the world, the South African government maintains an optimistic view regarding ICT implementation in schools. ICT is perceived as a panacea to many educational, social and economical problems. In a speech made by President Thabo Mbeki in 2001, he said: "We must continue the fight for liberation against poverty, against under-development, against marginalization" and "… information and communications technology … is a critically important tool in that struggle" (Imbizo for African Youth, 2001, as cited in the White Paper on e-Education (DoE, 2004:10). However, the state of ICT in South African schools is worth considering, with only 26,5% of schools in South Africa having access to computers for teaching and learning in 2002, according to the White Paper on e-Education (DoE, 2004:1-2).

The South African government's response to address the digital divide was to establish the Presidential International Advisory Council on Information Society and Development in 2001 (DoE, 2004). One of the council's key areas of focus was ICT in education, especially by addressing the digital divide (DoE, 2004). In addition, various other policy frameworks have been put in place to enable the integration of ICT into teaching and learning (Hodgkinson-Williams, 2005). These policies are dealt with in a number of documents published by the South African government, including the "Draft White Paper on e-Education (DoE, 2003), the Revised National Curriculum Statement documents for Grades R-9 for the General Education and Training band (DoE, 2001), the Draft National Curriculum Statement for Grades 10-12 (Schools): Computyping (Computer Applications Technology) (DoE, 2002a) and the Draft National Curriculum Statement for Grades 10-12 (Schools): Computer Studies/Information Technology/Computer Science) (DoE, 2002b)" (Hodgkinson-Williams, 2005).

Various successful initiatives have been taken in South Africa for the implementation of ICT in education. One of these is the Khanya Project of the Western Cape Department of Education. Some of the aims of the Khanya project are to ensure that curriculum is implemented, new technology is installed in classrooms and training is provided for teachers (Khanya technology in education, n.d.). Another major initiative dealing with computer integration in education is Blue IQ Project of the Gauteng Department of Education, and Gauteng Online (DoE, 2004). "Blue IQ is a multi-billion Rand initiative of the Gauteng Provincial Government to develop economic infrastructure for specific major projects in smart industries, high value-added manufacturing and tourism" (Blue IQ, n.d.).

The White Paper on e-Education (DoE, 2004) outlines the number of computers in schools in the various provinces in South Africa in 2002 for teaching and learning, as illustrated in Figure 2.4.

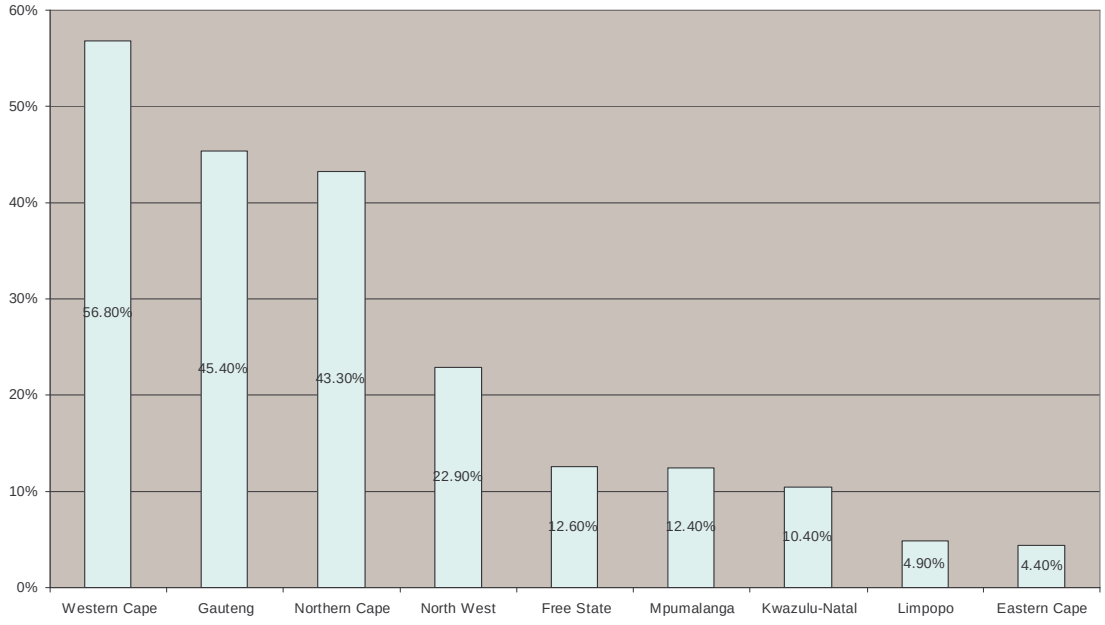


Figure 2.4: Percentage of schools with computers for teaching and learning in all provinces in South Africa in 2002 (Adapted from the White Paper on e-Education (DoE, 2004: 12).

The highest number of schools with computers is in the Western Cape (56.8%), Gauteng (45.4%) and the Northern Cape (43.3%). The Eastern Cape, which is among the poorest provinces in South Africa, has the lowest number of computers in schools

(4.4%) in South Africa. The White Paper on e-Education states that more schools have acquired computers for curriculum integration between 1999 and 2002, during which the number of computers increased from 12.3% to 26.5% (DoE, 2004). This figure shows that more and more schools are acquiring computers for teaching and learning. The White Paper on e-Education also notes that the growth rate in computers was higher in high schools than in primary schools (DoE, 2004). But a large number of schools are still without computers, especially in the poor provinces of the Limpopo and Eastern Cape (DoE, 2004).

2.10.9 ICT policies in various provinces in South Africa

a. Western Cape

The Western Cape Education Department (WCED) has developed the e-Education Policy Framework that incorporates many of the objectives outlined in the White Paper on e-Education (DoE, 2004). This policy framework has two major goals for the Western Cape regarding ICT in education: (1) Good management and service delivery through the use of ICT and (2) the use of ICT in the classroom to ensure that effective teaching and learning take place (WCED, 2004). The document was developed as a framework for the development of other documents, especially in relation to the issue of ICT in education (WCED, 2004). An example of one of the policies that are already being developed is an e-START policy (Chiles, 2005, e-mail). According to the e-Education Policy Framework (WCED, 2004:15-18) the following objectives were identified:

- Equity: equal access to all the infrastructure as well as equal competence in skills;
- Capacity building: training for staff and educators, as well as the coordination of training and technical support staff to educators; and
- Norms and standards for the implementation of ICT.

The Education Department in the Western Cape, provincial and local governments will be the main source of funding for these initiatives. However, the department will also welcome funding from the private sector. A public-private partnership will be developed to ensure funding of these initiatives. The WCED has embarked on an initiative to ensure the integration of ICT throughout the system (WCED, 2004). This

means that timeframes have been attached to certain aspects of the strategy to ensure implementation of ICT in schools.

b. KwaZulu-Natal

The KwaZulu-Natal (KZN) interim policy document has been developed within the broad framework of the National Action plans in Africa (KZN DoE, n.d.). This ICT framework was developed from the mission statement of the Department of Education in KwaZulu-Natal, which states that all schools shall be ICT capable by the year 2013, in line with the White Paper on e-Education. In order to achieve the goals as set out by the White Paper on e-Education, the KwaZulu-Natal Education Department has embarked on a Proposed Operational Plan, outlining the outcomes for ICT for the province. Some of the issues addressed in this plan include management structures, funding strategies, inter-governmental collaboration and provincial structures. Other issues include infrastructure, community development and curriculum development. It is hoped that the Provincial Treasury will fund the implementation of ICT in schools (KZN DoE, n.d.).

c. Mpumalanga

The Mpumalanga province has developed a project, called the Thuthuka project, as a framework to guide the implementation of ICT in the province. Phase two of the project was to start in 2004 and was to run over a three-year period. The aim of the project is reflected in the mission of the province: “To provide learner-centred life-long education and training through ICT” (Mpumalanga, DoE:1-2). The plan further sets out the goals for the Mpumalanga Department of Education (DoE) regarding ICT implementation, which include developing computer-skilled learners as well as to enhance learning through the integration of ICT in its schools (Mpumalanga, DoE).

Mpumalanga has established ten teacher centres to act as training centres for teachers, managers and administrators. The training will comprise of basic computer literacy skills for the novice computer user, advancing to expert computer skills training and in the use of ICT. It is hoped that by the year 2013 all educators, managers and administrators will have at least basic computer literacy skills. Mpumalanga’s DoE has set a goal that all schools that have electricity will have at least one computer for

administrative purposes by the year 2003. It also planned that at least 20 computer laboratories per year will be rolled out, starting from the year 2004. The total cost for these initiatives will be around R25 614 000 over three years. However, the DoE in Mpumalanga hopes that all schools undertake their own connectivity, for example through dial-up Internet excess. Although some of these initiatives were partly funded by the Mpumalanga DoE, it is hoped that additional funds will be obtained through public-private partnerships, donor projects and community partnerships (Mpumalanga, DoE).

d. The Eastern Cape

The Eastern Cape Provincial Strategy for ICT in Education (EC DoE, n.d) details the annual Education Management Information System (EMIS) survey of 2001, which states that there were only 371 schools in the Eastern Cape that had computers in 2001, and that on average there were only 1-14 computers in these schools.

The Eastern Cape Provincial ICT Strategy also mentions that computers in schools are generally used to teach basic computer skills such as word processing and that the Internet has become more accessible for teaching and learning (EC DoE, n.d.). The EC government has also committed itself to establish partnerships with a number of stakeholders, including the private sector.

The EC government is currently engaging in a project called ‘Connect Eastern Cape’, in which some schools are identified and equipped with technological equipment such as cables, computers, ICT equipment and satellite dishes, for Internet connectivity (EC District ICT Coordinator, 2004). She further states that, as part of the Connect Eastern Cape initiative, the private sector collaborates with the EC government. These companies make donations to identified schools in the form of computers and other technological equipment if the need arises. The government then supplements these schools with whatever is still needed at that particular school. According to the EC District ICT Coordinator, some companies in the private sector deal directly with the schools by equipping these schools with computers and Internet connectivity, without consulting government.

The government's role is crucial if effective implementation of ICT in schools is to be achieved. According to the EC Provincial Strategy for ICT in Education (EC DoE, n.d.) there are four approaches that the EC government has targeted to secure funding for the implementation of ICT in schools:

- funding from the Provincial Department of Education;
- the proceeds from the privatization of state enterprises;
- the proceeds from the licence fees of telecommunications companies; and
- bilateral agreements with international donor communities.

These funding initiatives are attempting to rectify the backlog in ICT in the EC schools (EC DoE, n.d.) However, taking into consideration that the EC has the least number of computers in its schools in South Africa, more should be done to ease this huge digital gap.

2.11 Conclusion

It is essential that in order to implement computers in schools, stakeholders, including the government, should be acquainted with the rationale behind the implementation of computers in schools. Failure to do so may result in computers not being utilized appropriately. Not only should we know why computers are needed, but also how to use them, especially with regard to integrating ICT within teaching and learning activities. It is therefore imperative that care should be taken to draw up ICT policies for implementation of computers in schools.

This chapter has attempted to examine the importance, rationale and use of computers in education, and more specifically, in schools. It has also attempted to analyze the ICT policies in education of a number of countries in Asia and Europe, Africa and finally South Africa, with specific reference to the ICT policies of a few provinces in South Africa.

Chapter 3

3 Research design

3.1 Introduction

This chapter describes the research design that was followed in this study. The chapter begins with a discussion of the research orientation within which the research was located. The goals of the research are then described, followed by an outline of the research questions. I then proceed with a discussion of the approach, a case study, and provide reasons why a case study was selected. The data gathering methods and research instruments that were applied in this research are then mentioned and explored. Although the research sample was small, I attempt to provide a brief explanation about the participants, and then discuss the reason why they were chosen. This is followed by a description of the method of data analysis. The chapter concludes with a brief description of the ethical issues and the limitations of the methodological approach that informs this research.

3.2 Research orientation

The research orientation that informs this study is the interpretivist research paradigm. The following paragraph discusses the role of the interpretivist researcher, followed by the rationale for choosing the interpretivist paradigm.

Neuman (2000) sees the interpretivist researcher as someone who interacts with the objects under study to get a deeper insight of the topic as a whole, and then sees how smaller parts relate to the whole. He writes that interpretive researchers do not see their interpretations as beyond question or superior to others' ideas (2000). Interpretive researchers usually do a thorough analysis of interview transcripts so that they can get a deeper insight of the transcripts under study (Neuman 2000). Janse van Rensburg (2001:16) states: "As interpretivist researchers, our design would reflect an interest in contextual meaning-making, rather than generalized rules." She points out that the emphasis in the interpretivist orientation is on the process of making meaning of the data, rather than attempting to

evaluate the data (2001). Cohen, Manion and Morrison (2000) state the distinctive factor of this paradigm is that it is centered on the individual person. Interpretivist researchers want to understand the person's interpretation of the world in which he/she interacts.

This perception is evident in my interaction with the research participants. I hoped to gain an in-depth view of the topic under study, which is: how are ICTs implemented in their schools? Following Neuman's (2000) interpretation of intrepretivist research, my objective was to make sense of the data in order to come to an in-depth understanding of the issues influencing the implementation of ICT in the various schools. Therefore, I chose to include qualitative research techniques (Bell, 1987; Neuman, 2000) to gather the data. Qualitative researchers make use of a wide variety of research methods and approaches, including case study methods (Denzin and Lincoln, 2000) that will be discussed later in this chapter.

3.3 Goals of the research

The goal of this study was to determine what ICT strategies, recommended by government and local schools, could inform the formulation of an ICT policy for my school, George Dickerson Primary School (GDPS). The research looked at how schools with computers or a computer laboratory in the Makana and Somerset East districts implemented ICT into their school curriculum.

Three out of five schools interviewed for this research fall within the category of 'previously disadvantaged' (PD) schools. GDPS may be described as a PD school. GDPS acquired a few computers through sponsorships, so the intention was to use the lessons learnt from other schools to guide GDPS in the formulation of their ICT policy.

3.4 Research questions

- What does the ICT practice in five primary schools in the Makana and Somerset East Districts of the Eastern Cape suggest about the implementation of ICT in a local primary school?

The two subsidiary questions are:

- How do a selection of local schools in the Makana and Somerset East Districts implement ICT in their schools?
- How can these practices inform the computer implementation process at George Dickerson Primary School?

3.5 Participants in the study

The participants in this study were chosen to provide a local perspective of ICT implementation in schools in the Makana and Somerset East districts (Table 3.1). The research sample was small, and included only five schools. The objective of this small sample was not to generalize to the wider population (Cohen, Manion and Morrison, 2000), but to provide information to inform the ICT implementation process at GDPS. This is what Cohen *et al.* (2000) describe as a non-probability sample. They write that this type of sampling is sufficient if the researcher does not use the information to generalize on the wider population, but simply use the information to inform the research. However, I hope that the information may be relevant to other schools and institutions with similar interests. My choice of participants was guided by which schools in the Makana and Somerset East areas had computers or computer laboratories available at their schools for teaching and learning. The selection of participants was informed by Kumar's judgmental or purposive (1996) sampling method. Kumar writes that within this sampling method, the researcher chooses the participants carefully to provide the best results for the research (Kumar, 1996).

From a governmental perspective, one Eastern Cape provincial government official was interviewed. We arranged to meet in her office at the provincial department of education in Zwelitsha in the Eastern Cape for the interview. The interview schedule was sent to her in advance, on her request, so that she could prepare prior to the interview (Appendix B).

I could not identify more people who could give me adequate information regarding ICT implementation in schools in either of the two district offices in Grahamstown and Zwelitsha. My assumption was that district officials would be well placed to provide sufficient information on ICT in schools, given that this falls within the ambit of

education policy. My supervisor gave me the names of people in Bisho and Grahamstown who might be of assistance to me. Unfortunately, they were unable to provide me with the relevant information. Fewer people within the Department of Education had knowledge of ICT in schools. The only person who was able to assist me, and whom I interviewed, was the then District ICT Co-ordinator in the Eastern Cape. Some of the officials did not respond to my initial attempts at establishing contact i.e. through e-mailing and telephonic communication, while others claimed that they did not have the time to meet with me.

To obtain a local perspective, five ICT coordinators from four primary schools and one secondary school in the Makana and Somerset East Districts were interviewed regarding ICT implementation in their schools. The selected schools were carefully chosen in order to provide a broad perspective on ICT practices in contextually different schools (see Table 3.1). The schools consisted of one FMC school, one independent school (IS), two FHOR schools as well as one former FDET school. Although the FDET school is not a primary school, I felt that it was important to include it as this school is currently the only PD school in Grahamstown that has a well-maintained computer laboratory and successfully implemented computers into their curriculum for teaching and learning.

The two FHOR schools are situated outside Grahamstown, one in Port Alfred in the Makana District, and one in Adelaide in the Somerset East District. The principal of the school in Port Alfred was the acting ICT coordinator at the school. Although he did not have formal training in ICT, he was nevertheless willing to be interviewed. The other FHOR School is situated in the town of Adelaide. Two educators at the school in Adelaide were chosen to be the ICT coordinators of the school. Although Adelaide is not part of the Makana District, I felt that it was important to include this school because at the time there were no other FHOR primary schools with ICT in Grahamstown, apart from GDPS.

Table 3.1: Schools according to number of interviewees and context of school

Schools	FMC	FHOR 1	FHOR 2	IS	FDET
District	Makana	Makana	Somerset East	Makana	Makana
No. of interviewees (ICT coordinators)	1	1	2	1	1
No. of learners in school	350	+ - 600	+ - 742	214	1094
Learner base according to race	Mixed, but predominantly Black	Coloured and predominantly Black	Coloured and predominantly Black	Mixed, but predominantly White	Black
Teachers according to race	Mixed, but predominantly White	Coloured, Black and White (2 volunteers from Germany)	Black and predominantly Coloured	Mixed, but predominantly White	Black
Learner base according to social status	Predominantly middle class	Predominantly poor	Predominantly poor	Predominantly middle and upper class	Predominantly poor
School fees per annum per learner	R4360 (gr. 1-3) R4500 (gr. 4-7) (2006)	First 2 learners in family pay R100 (2006)	R90 (2006)	Each grade has different fees R7000 – R9000 for day scholars (2006)	R120 R150 (if learner does woodwork) and art) (2006)

3.6 Data collection method

The case study method: I chose the case study method because of my interest in a specific case, and what can be learned from this case (Stake, 2000). The 'case' in this instance is the implementation of computers in schools. "A case study is both a process of inquiry about the case and the product of that inquiry" (Stake, 2000:436). The approach for this research is in the form of what Merriam (1998) terms an interpretive case study. She points out that the interpretive case study is used to develop data into theoretical categories in order to expand one's initial understanding of a topic. Cohen, Manion and Morrison (2000) point out that the interpretive researcher focuses on the participant's point of view rather than his/her own analysis of the situation.

The main rationale for selecting the case study is that it was particularly appropriate in studying real people in real-life circumstances without providing the reader with the researcher's own abstract ideas (Cohen, Manion and Morrison, 2000). In other words, researchers "retain the holistic and meaningful characteristics of real-life events" (Yin, 1984:14). I wanted to understand what other schools do regarding ICT, and my aim was to investigate and report on and interpret the situation as I encountered it.

3.7 Data collection tools

The case study approach is particularly useful because of its combination of qualitative and quantitative methods (Bell, 1987). These qualitative and quantitative methods include the use of documents and interviews (Leedy and Omrod, 2001) in this particular case study. The following section discusses the research tools, including interviews and document analyses that were used to gather data.

Interviews: The main purpose of the interview is to elicit responses from the interviewees by directing questions to them. This research made use of semi-structured interview schedules (Cohen, Manion and Morrison, 2000) (see Appendices D1 – D4). Furthermore, by means of open-ended questions, I hoped to get an in-depth understanding of the responses of the participants (Berg, 1998), allowing me to obtain a wider perspective of the issues regarding the implementation and integration of ICT in schools.

A ***tape recorder***, as opposed to writing notes, was used to capture data. Although interviewees, according to Blaxter, Hughes and Tight (1996), may feel at ease when the researcher writes down the responses from the interviewees instead of using a tape recorder, this process is slow and might result in the researcher missing out vital information while writing. This may lead interviewees to feel that their contributions were not valuable enough. By contrast, a tape recorder is faster, thorough and easier to manage. The problem with the tape recorder is that non-verbal communication for example the interviewees' facial expressions and body movements that might be useful for the interview, is eliminated to a greater extent (Neuman, 2000). This might result in vital information being lost during the transcription process. This aspect will be discussed in more detail later in the chapter. In addition, previous interviews that I have conducted exhibited the participants' uneasiness with the use of a tape recorder, forcing me to transcribe the interviewing process rather that relying on a tape recorder. This method can stall the interviewing process. Fortunately, participants in this study did not object to a tape recorder being used, and as a result I was able to transcribe the interviews for the interviewees to check and adapt if necessary.

Documents: In order to gain a broad insight into ICT implementation and integration in schools around the world, I analyzed documents emanating from four perspectives: (a) international policy documents and papers; (b) national governmental documents; (c) provincial governmental documents; and (d) local school ICT policies (see Table 3.2). These documents, called archival records (Nachmias and Nachmias, 1987) were obtained either online, or were hard copy documents obtained from government departments or on the Internet.

Table 3.2: Documents examined in this research

International	National and Provincial	Local
Papers concerning policy in ICT in Education and ICT policy documents from the following countries: 1. United Kingdom 2. The Netherlands 3. Norway 4. Ghana 5. Namibia	National policy documents in ICT in Education. Provincial policy documents in ICT in Education from the following provinces: • Western Cape • KwaZulu-Natal • Mpumalanga • Eastern Cape	School ICT policy documents from one of the participating schools: • FDET school
Source: online	**Source: online and hard copy**	**Source: hard copy**

International documents included papers concerning ICT policy in education from developed countries in Europe such as the United Kingdom, the Netherlands and Norway. These documents were obtained online. In order to gain a perspective regarding ICT in Education from developing countries, I analyzed ICT policies from two African countries, Ghana and Namibia. However, following an extensive Internet search, I could not locate ICT policies that were directly related to education from many African countries, especially Ghana. I was therefore compelled to include documents that portray a general perspective of ICT in Ghana.

From a national perspective, I included governmental policy documents in hard copy form or documents that are available online. Online documents included provincial policies in ICT, specifically ICT policies for secondary and primary schools. Five provinces' ICT policies in education were analyzed to inform the research. These provinces are Western Cape, Eastern Cape, KwaZulu-Natal, Mpumalanga and the Free State. To obtain these documents, I initially corresponded with the Education

Development Manager at SchoolNet South Africa (Thompson, personal communication, March 30, 2005), who gave me the names of the various stakeholders from other provinces managing ICT in Education. I then proceeded to correspond with the ICT stakeholders from the various provinces via electronic mail, telephone and facsimile. I received responses from a variety of stakeholders in ICT in many provinces of the country, including the director of Information and Technological Services in the Western Cape, the director of e-Education and IRRISS in the Free State, the First Education Specialist regarding e-Learning in the Free State, the Director of ICT in Education in the Limpopo Province, and the ICT Projects Coordinator of the Eastern Cape. The ICT documents in education from these provincial bodies included the Implementation Plan for the ICT Programme 2004-2006 of Mpumalanga, the e-Education Policy Framework 2004 of the Western Cape, an ICT/e-Education Conceptual Framework of KwaZulu-Natal, the E-Education proposed Implementation Framework for Schools to reach 1400 schools from 2004/2005 to 2009/2010 – A helicopter view of the Free State (Free State DoE, 2004), and the Provincial Strategy for Information and Communication Technology in Education of the Eastern Cape. All these policies were still in draft form during the drafting of this thesis, and were therefore unpublished material. I obtained special permission via electronic mail and telephone conversations from the various stakeholders concerned to use these policies in my thesis. Unfortunately, I could not include the ICT policies from the rest of the provinces in South Africa – either because they did not have ICT policies available, or the policies were not completed at the time, or I did not receive a response when I requested these policies via electronic mail.

From a local perspective, I included information from an ICT policy document from only one of the five schools that were part of this research. This school was a former Department of Education and training (FDET) school. The two former House of Representatives (FHOR) schools as well as the former Model C (FMC) school did not have formal ICT policies for their particular schools. The Independent School (IS) did have an ICT policy in place, but unfortunately I could not obtain the ICT policy document from it.

For my literature review, I included information emanating primarily from international, national and provincial documents.

All of the documents mentioned above are described as secondary data sources (Kumar, 1996; Blaxter, Hughes and Tight, 1996:151-153), and according to Kumar (1996) these documents are readily accessible to be analyzed and interpreted.

3.8 Classification of schools

Prior to the 1994 democratic elections, all of these schools were segregated along racial lines. For example, the FMC schools were transformed into Section 21 schools with self-governing rights and responsibilities. The former private schools, now called independent schools (Du Toit, 1994), had a mainly white majority learner base in Apartheid South Africa. However, in post-Apartheid South Africa, black learners make up more than 70% of all learners at these schools (Du Toit, 1994). Although more than half of all IS have school fees that are high or average (Du Toit, 1994), school fees in previously white schools remain a burden for many black parents who cannot afford them (Vally, 1999). Previously, the FHOR schools comprised of mainly 'coloured' pupils and teachers, while the FDET schools had a population of mainly black pupils and teachers. Government policies in the Apartheid era resulted in these schools being understaffed and under-resourced. In post-apartheid South Africa, the former DET schools in Grahamstown still have mainly black pupils attending the school, while the remaining schools have integrated other races in its schools. The FMC and the FHOR schools in Grahamstown have a predominantly black learner base in post-apartheid South Africa (Hodgkinson-Williams, 2005).

Much of the complexities of the Apartheid era have been inherited by the present democratically elected government. These include problems in the education system. Many of the schools in this country, especially the FDET and FHOR schools, still have insufficient resources, under or unqualified teachers, and overcrowded classrooms, among other problems (Vally, 1999).

Special care was taken in the selection of this sample (Kumar, 1996). The above-mentioned schools were selected to highlight and analyze problems and practices concerning ICT implementation in their schools. I intentionally included PD and PA schools in the sampling to highlight the differences at these particular schools. The unofficial classification of GDPS as a PD school has prompted me to include similar PD

schools in the sample. I wanted to know how parallel PD schools implemented their computers, and to use these ideas to inform the ICT implementation process at GDPS.

3.9 Data analysis

Data from the semi-structured interviews were analyzed using a system called coding schemes (Nachmias and Frankfort-Nachmias, 1996). The purpose of coding schemes is to categorize the data into smaller clusters of similar content to allow simple analysis of the data (Lazarsfeld and Barton, cited in Nachmias and Nachmias, 1987). A computer word program, MSWord® (see Appendix C), was used to categorize and group this data into smaller clusters according to the questions that were asked.

Nachmias and Nachmias (1987) distinguish two kinds of coding schemes: deductive and inductive or in vivo coding. According to them, deductive coding is mostly used within questionnaires and surveys where data has been pre-categorized prior to the responses of the participants. A good example is the close-ended questionnaire. In contrast, inductive coding (Nachmias and Nachmias, 1987) involves the categorization of the raw data after the data has been recorded. This type of inductive coding was used to analyze the data in this study. I started by transcribing the data from the tape recorder that was used to record the participants' responses. This raw data from the transcripts, which included the responses from each of the interviews, were then organized into major coded sections according to the key themes that emerged. I proceeded to group together these coded sections in order to determine the main argument in each of these sections (Dexter, Seashore and Anderson, 2002). A spreadsheet computer program, MSExcel®, was used to organize the data into coding schemes (see Appendix E).

A few problems arose from the process of data analysis. Transcribing interview data from the tape recorder resulted in the loss of original data during the transcribing process due to unclear articulation on the tape recorder and the impossibility to record everything that took place during the interview (Cohen, Manion and Morrison, 2000). Non-verbal data is lost during the recording process. However, I attempted to include or at least mention the following non-verbal data in the transcripts: the fluctuation of the voice, for example soft and loud voice tones, the mood of the interviewees, for example excitement; background noises for example talking and laughing; interruptions, for example when the interviewee asks me to stop the recording for a certain purpose such

as private issues that she/he did not want to be included in the interview; and interruptions where the cassette in the recorder was finished and had to be turned. To me, this kind of record keeping is important because it enabled me to understand and interpret the data at a deeper level (Cohen, Manion and Morrison, 2000) and therefore gains a deeper understanding of the issues under discussion.

In contrast to interviews, where coded schemes were used, documents were reviewed in the light of the information that was given. Nachmias and Nachmias (1987) refer to this as content analysis.

> Content analysis is 'any technique for making inferences by systematically and objectively identifying specified characteristics of messages'. Researchers guarantee objectivity by carrying out their analyses according to explicit rules that enable different investigators to obtain the same results from the same message or documents. That is, in a systematic content analysis, the 'inclusion or exclusion of content is done according to consistently applied criteria of selection; this requirement eliminates analysis in which only materials supporting the investigator's hypotheses are examined (Holsti; Nachmias and Nachmias, cited in Nachmias and Frankfort-Nachmias, 1996:324-325).

In short, the messages contained in these documents (Nachmias and Frankfort-Nachmias, 1996) were of particular interest to me (see chapters two and four).

3.10 Validation of data

Neuman (2000) and Cohen *et al*. (2000) maintain that there can be no guarantee that research information can be one hundred percent valid. There will always be questions as to the 'correctness' of the data. Cohen *et al*. (2000) recommends that to ensure greater validity bias have to be to minimize wherever possible. Although not flawless, I attempted as far as possible in my interviews with the participants to ensure that bias was minimal in terms of my attitude towards the interviewees, the questions that I have put forward and my response to their answers (Cohen *et al, 2000*). This has guaranteed an open relationship between my interviewees and myself and has secured greater validity in terms of the answers that the interviewees gave me.

In terms of sample size, Cohen *et al*. (2000) assert that there is no guarantee that a large sample is representative of the whole population, although a smaller sample may be equally unrepresentative. Although the sample size was small in this research, I feel that the data gathered from these samples was sufficient to give an overview of the

sample schools and that schools in similar situations might gain valuable information from the research.

3.11 Ethics of the research

Copies of the outline of the study, as well as an explanation of why the study was conducted, were given to all the interviewees. If preferred, copies of the proposed interview schedules were sent to all participants prior to the interview. Following the interviews, four out of six participants were sent copies of the first drafts of the transcripts for their verification. Due to the geographical location of the participants, compounded by the lack of electronic mail at the FHOR schools, it was not easy to send them the copies of the transcripts for their verification. Finally, participants are acknowledged and thanked in the thesis. In addition, a letter of appreciation will be sent to all the participants that were involved in the study following the completion of the thesis.

I was willing to uphold confidentiality if the participants requested it (Cohen *et al*, 2000). To uphold confidentiality, according to Cohen *et al*, the interviewer can only promise not to reveal the identity of the interviewee, especially in the light of the face-to-face interview. In this interviewing process, I ensure confidentiality by managing to capture the confidence of interviewees by revealing what the purpose of the interview was that prompted them to divulge information that I needed for the research (Gillham, 2000). According to Gillham, disclosing the purpose of the interview is part of the issue of confidentiality.

3.12 Conclusion

This chapter explained the qualitative research methods that informed the research. Firstly, it discussed the reasons for the selection of the interpretivist approach, and the choice of the case study method. Secondly, I explained the interview methods that were selected, in particular the semi-structured interview, as well as the data collection methods. Thirdly, the sample of participant schools in Grahamstown, Adelaide and Port Alfred were described in terms of the number of participants that were interviewed, as well as the contexts of the particular schools. Fourthly, the data analysis techniques for the interviews and documents were broadly described. Fifthly, the validity issues that

informed the research were specified, and the chapter concluded with the ethics that were part of the research process.

Chapter 4

4 Findings

4.1 Introduction

This chapter discusses the findings of my survey at the five schools that participated in the research. It commences with a discussion of the strategies that the schools used to obtain the computers. To clarify how these schools acquired their computers, I will provide details on who donated the computers, specifying how individuals started initiatives to obtain computers. This is followed by a comparison of the number of computers in the five different schools. I then provide a detailed analysis on how these schools utilize the computers, explaining the reasons for their utilization or non-utilization. The importance of a computer coordinator, computer committee and an ICT policy is then considered with specific focus on the roles and importance of these committees and coordinators at each school. Furthermore, I will discuss briefly how computers are maintained in these schools. This is followed by pointing out the significance of teachers' use of computers at these schools. In conclusion, I will briefly consider the importance of Internet connectivity as well as community and private sector involvement in these schools.

4.2 Acquisition of computers

In response to the first question, "How did your schools obtain computers?" seven separate strategies of obtaining computers were identified (Table 4.1):

- Donations;
- School funds;
- Fundraising;
- Loan;
- Hire purchase lease;
- Social responsibility project; and
- Pupil competitio

Table 4.1: How schools obtained computers: Number of strategies used by each school

What strategies did schools use?	FHOR1	FHOR2	FMC	IS	FDET	No. of schools
1. Donations	√	√				**2**
2. School funds			√	√		**2**
3. Fundraising				√		**1**
4. Loan				√		**1**
5. Hire purchase lease			√			**1**
6. Social responsibility project					√	**1**
7. Pupil competition					√	**1**
8. DOE support						**0**
No. of strategies	**1**	**1**	**2**	**3**	**2**	

Table 4.1 reflects the various options these schools employed to obtain computers. The two former House of Representatives (FHOR1 and FHOR2) government schools obtained their computers through private donations. The former Model C school (FMC) obtained its computers by leasing the computers through a hire purchase lease, which they had to pay off from the school funds over three years. The Independent School (IS) paid for their computers through school funds in addition to taking a loan from the Schools Independent Council. Moreover, the parents of this school also managed to raise funds to acquire the computers for the school. The Former Department of Education and Training (FDET) school obtained their computers through a social responsibility project known as the Khula Project, as well as through a pupil competition. The strategies that the FDET school employed will be discussed in detail later in this chapter.

It is interesting to note that the IS employed three strategies to obtain computers, while both the FMC and the FDET made use of two strategies. Both the FHOR1 and FHOR2 schools obtained their computers through a single strategy.

Table 4.1 reveals that the most likely ways of obtaining computers for a school are through donations and school funds. While strategies such as fundraising, loans, leasing of computers, projects and competitions are additional approaches to acquire computers, the survey reveals that the Department of Education (DoE) do not support these schools in any way, even though the White Paper (2004) implies that they should be involved in assisting schools to acquire computers.

I recommend that GDPS should not contemplate a single way, but consider combinations of the various approaches as outlined above to acquire additional computers. Although GDPS has already received a few computers through donations, further options such as participation in projects and pupil competitions should also be considered as strategies. Unfortunately, GDPS cannot rely on school funds to acquire computers because of the school's poor financial position. At the moment, the annual school fee per learner is R100, but because school fees are not compulsory in government schools in South Africa, the school cannot accumulate enough fees per year to maintain the school effectively.

4.3 Who donated or provided the computers to these schools?

Further details on the donors or providers of computers to these schools are illustrated in Figure 4.1. At least nine sources were identified:

- Four sources of *donations* (overseas companies, higher education institutions, local companies and an ex-pupil);
- Two sources of *school funds* (loan, hire purchase lease);
- One source of *fundraising activities* (parents);
- One *social responsibility project* (Khula Project);
- One *pupil competition* from the Planet Project.

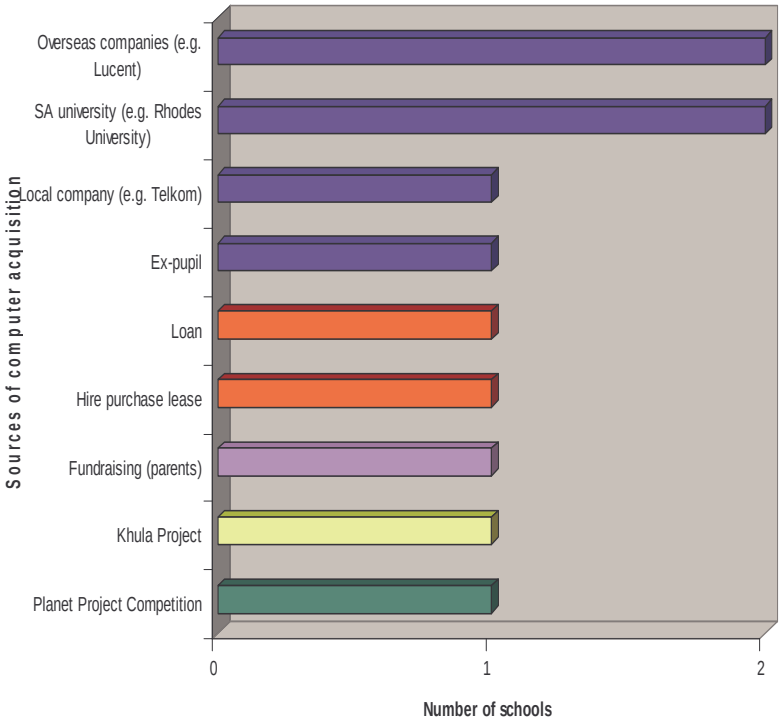


Figure 4.1: Sources of computer acquisition

Oversees companies donated computers to the FHOR1 school through the President's Awards Project. Rhodes University and a local company, Telkom, donated computers to the FHOR2 school. This school also received a computer from an ex-pupil of the school.

The School Governing Body (SGB) of the FMC school acquired twenty new computers, out of a total of thirty five, for their computer laboratory. The SGB initially hired the computers and then paid them off over a period through a special maintenance fund that has been set up for this purpose. The remaining fifteen old computers have been relocated to the classrooms for teachers' use.

Various intensive fundraising activities by the parents of the IS ensured that funds were raised over a period of a year to establish a computer laboratory at the school. The cost of the laboratory was in the region of R160 000. The computers for the IS were financed through a loan from the Independent Schools Council, of which the IS is a member. The school will repay this loan over an agreed upon period.

By participating in various projects, the FDET school managed to obtain computers and a camera for their school. As part of the Khula Project, Lucent Technologies donated four computers to the school. This donation was made possible after four teachers from the school completed a computer literacy training programme at Rhodes University. The Khula project involved the University of Fort Hare, the University of Port Elizabeth (UPE) and Rhodes University. It was organized by the Rutgers University Council for Southern Africa, and intended to develop science by training high school educators (Council for Southern Africa and the Office of the Associate Provost for University Outreach, 1998). The FDET school acquired an additional computer by taking part in a Science competition. The school also participated in another project called the Planet Project (FDET ICT coordinator, 2003), which was organised by SchoolNet. SchoolNet is a non-profit organization for teachers and pupils in South Africa to improve learning through the use of ICTs in schools (SchoolNet, 2003). Pupils had to submit entries to describe how the project benefited them. Their winning entries ensured that the FDET school received 16 brand new computers. At the same school, a pupil won a digital camera for the school through another project called the Global Teenager Project, also initiated by SchoolNet. This project intends to encourage teenagers in rich and poor countries to interact with each other so that young people can learn about different cultures and environments. (SchoolNet SA, 1999 as cited in Turyagyenda, 2003). The pupil at the FDET school, who won the camera, designed the winning logo for the Global Teenager Project website (FDET ICT coordinator, 2003).

The DoE in the Eastern Cape (ECDoE) promises to support schools that want to acquire computers or establish computer laboratories in their schools. The Provincial Strategy for ICT in Education for the Eastern Cape states:

> The Department should designate a unit for *Information and Communication Technology in Education* that will spearhead the Information Management Unit. The purpose is to guide schools in determining their information needs through identification and dissemination of information. The unit will assist with the provision of IT infrastructure with the aim to oversee the integration and implementation of ICT as well as support and maintenance of schools (Eastern Cape, ECDoE, 2001:6).

According to the ECDoE, there are structures in place, through the use of district coordinators, to support schools wanting to implement computers in their schools:

> Subject advisors are supposed to go there [to schools where there are computers] and be of support to the teachers…We're using … Maths…and Science subject advisors…And we're looking at the breadth of technology as also encompassing ICT. Then those Maths and Science [subject advisors] because we don't have technology subject advisors yet… act as our district coordinators. So whenever there is support that needs to be provided to the school, we do that through the district coordinator (EC District ICT Coordinator, 2004).

In my interviews with the six coordinators of the five schools that participated in this study, not one indicated that the ECDoE had provided any support, either through subject advisors or district coordinators.

This is a clear indication of how schools need to tap into a variety of sources to acquire computers for their schools. Table 4.1 illustrates that two 'previously disadvantaged' (PD) schools, the FHOR1 and FHOR2 schools, depended primarily on donations for their computers, while two 'previously advantaged' (PA) schools, the FMC and IS, bought their own computers, either through fundraising activities by the parents or through loans. However, the most creative ways of acquiring computers can be seen in the fundraising activities of one of the PD schools, the FDET school. This school has participated in a number of projects and competitions via the Internet to acquire computers. The evidence also reveals that the ECDoE has plans to provide ICT infrastructure to schools as well as support through district coordinators.

Although the school community is too poor for the parents and the SGB to raise funds, GDPS can follow the example of the FDET school and utilize the Internet to participate in projects and competitions to acquire additional computers and peripherals for the school. With a sponsored computer laboratory and Internet connectivity at the school, the school is in an ideal position to achieve this goal. In addition, GDPS can maintain a good relationship with the ECDoE through correspondence mail.

4.4 Who initiated the acquisition of these computers?

In order to further probe how the schools managed to obtain these computers, a question was raised: Who initiated the process of obtaining the computers? The following people were identified in the interviews: one principal, two champion teachers, the SGB of one school, and the parents of another school (Table 4.2).

Table 4.2: People who initiated the process of acquiring computers for the school

	FHOR1	FHOR2	FMC	IS	FDET	TOTAL
Principal	√					1
Champion teacher		√			√	2
SGB			√			1
Parents				√		1

The previous principal of the FHOR1 school started the initiative of obtaining computers for the school. At the FHOR2, a champion teacher, who is also the computer coordinator of the school, initiated the computer implementation process. At the FMC school, the SGB of the school guided the implementation of computers by leasing the computers for the school. Parents of the IS initiated the implementation of new computers for the school by organizing intensive fund-raising activities. A champion teacher was responsible for obtaining computers for the FDET school through arranging for pupils to participate in a competition and various projects. This school did not have computers and Internet connectivity to participate in the competition, which resulted in the champion teacher organizing alternative means to enable the pupils to participate. The school's computer coordinator explains:

> We entered about fourteen students; by that time we did not have Internet… So [a professor of ICT at Rhodes University] was so supportive, she allowed us to use the lab at Rhodes University. At first we took fourteen students to collect information over four days. In that Planet Project, ten students gave up, and I completed with four enthusiastic boys, who eventually submitted their entries – about two and a half pages including graphs and explaining what they have learnt from the project. It was through those entries that won us the 16 brand new computers (FDET ICT coordinator, 2003).

Through hard work and dedication, champion teachers take the lead when it comes to implementing computers (Table 4.2). Two PD schools, the FHOR2 and FDET, had champion teachers who initiated the process of computer implementation. Champion teachers at GDPS can find creative and alternative solutions in complicated situations to overcome barriers in the implementation of computers at the school. Evidently, it is not always champion teachers who initiate the process to obtain computers, but also the parents and the SGB of the school. The parents of GDPS should be urged to partake in

the implementation process. Raising funds to help with the implementation of computers can accelerate this process. The SGB, on the other hand, should be well informed on the processes and intricacies involved in the implementation process, so that they will be capable of taking a lead in future endeavours.

4.5 Number of computers in each school

The number of computers in each school varies significantly. The two of the PD schools who do not have computer laboratories managed to procure only a few computers for their schools. In contrast, the two PA schools have an adequate number of computers and computer laboratories. The number of computers and computer laboratories and the location of computers of each school are illustrated in Table 4.3.

Table 4.3: Computers in the schools

School	No. of computers	No. of computer laboratories	Location of computers	Year
FHOR1	7	0	Old classroom	2004
FHOR2	11	0	School library and staff room	2004
FMC	35	1	Computer laboratory and classrooms	2004
IS	26	1	Computer laboratory	2004
FDET	29	2	Computer laboratories	2003

Table 4.3 illustrates that the FHOR1 school has seven sponsored computers that are functioning. This school does not have a 'formal' laboratory either; instead, the computers are located in an old classroom. The FHOR2 school has 11 computers, of which only four are functioning. The school does not have a computer laboratory, but stores the computers in the school library. One functioning computer is kept in the staff room and utilized for administration work. The FMC school has the highest number of computers (35) and has one computer laboratory which accommodates 20 workstations.

The rest of the computers are located in the classrooms. The IS has 26 workstations in their computer laboratory. The FDET school has two computer laboratories with 29 workstations altogether. In this school, six computers are installed in the 'old' computer laboratory (the first computer laboratory that was installed at the school) and 14 computers are installed in the 'new' computer laboratory. Four of the computers are stand-alone computers, while the rest of the computers are in disrepair.

GDPS is privileged to have a computer laboratory with 18 sponsored old computers. With the acquisition of new computers for the school, the old computers can be placed in individual teachers' classrooms for the use of teachers and learners. Furthermore, the staff room is used as an additional venue for old computers to be used for administrative work by individual teachers.

4.6 The utilization of the computers

The evidence suggests that the schools use the computers in the following ways (Figure 4.2):

- Administration
- Teaching and learning
- Computer literacy training
- Internet research
- Projects and assignments
- E-mail
- Presentations
- Educational games

Figure 4.2 illustrates that four schools make use of computers for administration, while three schools use the computers for teaching and learning, computer literacy programmes, Internet research, projects and assignments, as well as e-mail. However, only one school integrates electronic presentations in its lessons, while another school sees educational games as a valuable source of teaching.

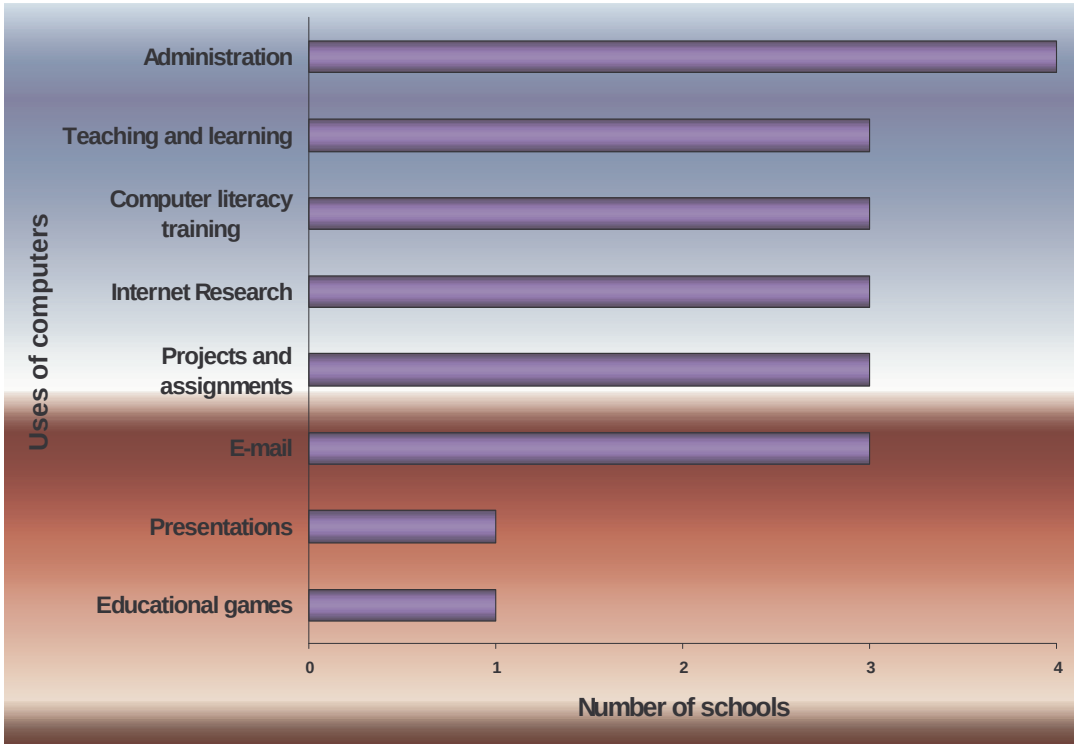


Figure 4.2: The uses of computers

Table 4.4 reveals in more detail how the schools utilize the computers for the above-mentioned purposes. It shows that only the FHOR1 school does not utilize the computers in any way, while the FHOR2 school uses the computers only partially. Three schools, the FMC, IS and the FDET, integrate the computers into the curriculum. The uses of computers in these schools will be explained in detail in the following paragraphs.

Table 4.4: Utilization of computers

School	Are the computers utilized?	How are computers utilized?	Timetable
FHOR1	No		No
FHOR2	Partly	Administration and educational games	No
FMC	Yes	Administration, computer literacy classes, projects and assignments	Yes
IS	Yes	Administration, computer literacy classes, projects and Internet research	Yes
FDET	Yes	Administration, computer literacy classes, projects and Internet research and in-service training for teachers	Booking system

The FHOR1 school's computers are not utilized at the moment, but they plan to avail the four working computers for the teachers' use only. The reason they are not using the computers is that they are old, and are running Windows 95.

The FHOR2 school is in a similar situation. They do not have a computer laboratory, so the computers are kept in the school library. This creates a few problems, because the library books can disappear when pupils are utilizing the computers, and the room is too small to be used as a computer laboratory. But unlike the FHOR1 school, the pupils use the computers for mathematical games and other literacy and educational purposes. There is no structured timetable, but any pupil who wants to make use of these computers is allowed to do so under the supervision of a teacher.

The computer coordinator of the FMC school teaches computer literacy classes from Grades 2 to 7. She also allocates assignments and projects for the pupils to do, starting

from Grades 5 to 7. Each class teacher has an old computer in his/her classroom, and only takes the pupils to the laboratory for computer literacy classes. The school follows a strict timetable, in which each class is permitted two hours per nine-day cycle in the computer laboratory.

Of the three PD schools, only the FDET school is utilizing the computers effectively. With an Internet connection, sponsored by the Telkom Centre of Excellence, they have regular sessions for pupils as well as teachers wanting to use the computer laboratory for research, assignments or printing purposes. The teachers bring their classes to the computer laboratory and instruct the pupils themselves, mainly to do Internet research. Computer skills were not taught at the school for a while, because the computers' hard drives were malfunctioning. However, a follow-up interview revealed that the computer coordinator started computer literacy classes for grades 10 – 12, after the faulty computer hard drives were replaced. The school does not have a formal timetable, but uses a booking system for the use of the computer laboratory. Any teacher or class who wants to use the laboratory must book the laboratory with the computer coordinator. Initially this system worked adequately, but a follow-up interview revealed that problems have arisen because of the booking system. These included the computer laboratory that was not used adequately for teaching and learning.

The IS has computer literacy classes for all the grades, from Grades 3 to 7. The classes start with the Grade 3 pupils, who are taught basic computer literacy skills. The computer literacy that is being taught gets more sophisticated in each progressing grade. For example, the Grade 3s start with basic computer skills: how to use the mouse, working with e-mail, logging on and off and how to cut and paste. They also have software for the pupils to work on such as *Maths Circus* to be used for Mathematics and *Encarta* to be used as an encyclopaedia. In Grade 4, they advance to learning how to use applications programs such as MSWord®, how to type and how to start working on projects. In Grade 5 they do many projects and language work on the computer. The upper classes have a firm base in computer literacy skills, which leads to the grades 6 and 7 pupils using the computer mainly for research. The Grade 6 classes do a great number of book reviews and use *PowerPoint* presentations for these lessons. The Grades 7s do numerous projects in various subjects such as English, Geography or History. The class teacher is responsible for allocating these projects to the learners,

while the computer coordinator makes sure that they use the appropriate applications such as MSWord®, the suitable fonts and how to use the computer to produce a satisfactory project. The computer coordinator is responsible for drawing up the timetable for the laboratory, and each class is allocated two computer lessons of 35 minutes each per week. The computer lessons are integrated within the standard timetable of the school, and because of the relatively small classes, there is one computer available for each pupil.

All the schools, with the exception of the FHOR1 and FHOR2 schools, use the computers for teaching and/or learning. In the case of the FHOR schools, the non-integration of ICT into the curriculum can be attributed to a lack of computers and computer resources. While the FMC, IS and FDET schools have good working computers and formal computer laboratories, these former two schools lack adequate computers and computer laboratories. Another factor is a lack of computer skills training among teachers. Not many teachers at the PD schools are trained in computer skills, and the teachers who are trained, often do not have the necessary competence to integrate computers into the curriculum. In addition, many of the computers at the FHOR1 school are in disrepair. Moreover, the FHOR1 and FHOR2 schools do not have a structured timetable to integrate computers into the curriculum.

The FMC, IS and FDET schools use their computers effectively. These schools have Internet connectivity and computer laboratories to improve the integration of computers into the curriculum. The Internet is used for educational research and e-mail. The computers at these schools are used to do projects and assignments, as well as for computer literacy training.

GDPS, with a computer laboratory and Internet connectivity sponsored by the Telkom Centre of Excellence at Rhodes University, can use their computers for research, computer literacy classes as well as projects and assignments. The research has revealed that there are complications with the use of a booking system. Therefore, I recommend an integrated, structured timetable for the effective use of computers in the school. Computer literacy classes can start at an early age, in Grade One. The computer skills training can become more sophisticated as the pupil progresses in each grade. In the upper classes, the Internet can be used for research and the computers can be used to type projects and assignments. To achieve this, I recommend that the school

should have a carefully constructed ICT policy that includes timetabling and ICT integration into the curriculum. The computer committee and ICT coordinator, in consultation with the staff, SGB and parents of the school, should jointly develop the ICT policy.

4.7 ICT policy, computer committee and ICT coordinator

To the question "Does an ICT policy exist at the school?" only two of the five schools, the FDET school and the IS, could answer in the affirmative. An additional question was posed which enquired whether the schools have an ICT committee and/or ICT coordinator (Table 4.5).

> The aim of drawing up the policy at the FDET school is to guide teachers and pupils whenever they want to make use of the computer laboratory. It was drawn up as a manual for when problems arose out of the use of the laboratory. The following problems were encountered before the policy was drawn up: teachers did not want to leave the laboratory after the bell had rung, and the principal kept the keys, thus compelling the ICT coordinator to collect the keys from the principal every time she needed to use the laboratory. "[The ICT policy] binds the teachers so that you don't get all those problems going on and on" (FDET ICT coordinator, 2003).

In the case of the IS, they share an IT policy with their partner schools. The policy was established as a guide for pupils to use the computer laboratory responsibly. The policy, which they call the Acceptable Users Policy, was slightly altered for the primary school because of the younger age of the children. Strict disciplinary procedures are followed if any pupil is found guilty of breaching the policy. For example, when a couple of boys contravened the policy, letters were sent to their parents informing them about the transgression. They were then refused entry into the computer room unless under the supervision of a teacher (IS ICT coordinator, 2004). The IT coordinator at one of the sister schools makes all decisions concerning the computer laboratory infrastructure.

Not all of these schools have established an ICT committee (Table 4.5). A more detailed discussion on the role of the ICT committee, where applicable, and the members representing this committee follow in the next paragraph.

Table 4.5: Schools with/without ICT committees

School	ICT committee?	Who and how many are represented?	ICT policy?	ICT coordinator?
FHOR1	No		No	Yes
FHOR2	Partly	2 teachers	No	Yes
FMC	No		No	Yes
IS	Partly	1 teacher	Yes	Yes
FDET	Yes	10 teachers	Yes	Yes

The FHOR1 school is one of two schools that does not have an ICT committee. The FHOR2 school has a partial ICT committee that consists of two different sections; the library section and the computer section. Two teachers represent the computer section of the media committee. They have been chosen to represent this committee because of the limited computer training they received in their final year at college. None of the other teachers at the school have received any formal computer training. The FMC school is the other school that does not have an ICT committee. This school has one ICT teacher who makes all the decisions regarding the computer laboratory. The IS do not have a separate computer committee, but have regular committee meetings at one of the sister schools regarding ICT. The FDET school has ten members that are represented on their ICT committee: eight computer literate teachers who have been trained by the Khula Project and two computer literate teachers who have been trained by the World Bank represent the ICT committee. It was not revealed during the interviews what roles were allocated to the ICT committees at the two schools with ICT committees.

Another question "What is the role of the ICT coordinator at the school?" was asked of schools with ICT coordinators. The evidence suggests that an ICT coordinator plays an important role in the utilization of computers at a school. The ICT coordinators at these schools have the following responsibilities:

- Undertaking administrative work;
- Supervising the laboratory;
- Teaching computer literacy skills;

- Overseeing the maintenance of the computers;
- Liaising with sister schools regarding maintenance;
- Reporting problems and make suggestions regarding the computer laboratory;
- Rectifying problems in the computer laboratory;
- Attending ICT meetings; and
- Opening and locking up the computer laboratory.

The ICT coordinator at the FHOR1 school does not have an active role to play due to the malfunctioning of the computers.

The responsibilities of the computer coordinators at the FHOR2 school include administration work. They are also responsible for opening and locking the computer room for the pupils.

The computer coordinator at the FMC school makes suggestions to the headmistress and the SGB of the school regarding computer requirements. The headmistress or the SGB will either approve or disapprove of these suggestions, or they will make alternative suggestions to the ICT coordinator. In addition, the ICT coordinator, who is also a teacher at the school, is responsible for teaching computer literacy skills, such as word processing, spreadsheets and databases. As mentioned before, she is responsible for maintaining the computer laboratory by liaising with the headmistress and the SGB if the need arises. One drawback at the FMC school is that there needs to be at least two IT teachers to share ideas. As the IT coordinator explains:

> At the moment I'm just left to my own devices as to what needs to be done… And most of the time I'm not sure if I'm doing the right thing…I think if there [were] two or three people [to help me] that would be nice.
>
> (FMC ICT coordinator, 2004)

The ICT coordinator at the IS, with the assistance of the IT maintenance manager, is the liaison between the sister schools. Their task is to rectify problems that arise out of the computer laboratory. They both attend regular monthly ICT meetings at the sister schools. The ICT coordinator also teaches computer literacy classes up to Grade Seven.

The FDET school's ICT coordinator is the supervisor at the computer laboratory during training sessions. She is exempted from extra-curricular activities. She sees the extended hours that she spends in the computer laboratory as part of her extra-curricular

activities. Other duties of her include opening and locking up the laboratory after it has been used. She has also started to teach computer literacy classes to pupils and teachers.

Only two of the five schools, the FHOR2 and the FDET schools, have ICT committees at their schools. The FHOR2 school has only two members represented on the ICT committee, which is part of the bigger media committee. Regarding the FDET school, it was not clear from the interview what roles were allocated to each of the ten members representing the computer committee. Evidently, the computer coordinator at each of these schools has significant responsibilities, including supervising the laboratory, and overseeing the maintenance of the computers.

However, the computer coordinator does not need to be overwhelmed with tasks and responsibilities, especially if he or she has a full-time teaching position and needs to be in the class most of the time. Ideally, there should be a computer committee with specific roles and responsibilities that manages the computer laboratory. GDPS is fortunate to have an ICT committee with four members representing the following portfolios (see Appendix F):

- Supervisor;
- Fundraiser;
- Equipment manager; and
- IT specialist.

The objective of the ICT committee at GDPS is to minimize the workload of the coordinator. Ideally, the computer committee should conduct regular meetings, including meetings with staff and other stakeholders, to resolve problems that might occur in the computer laboratory. The ICT coordinators should not be obliged to do administrative work for teachers, as this impacts on their own responsibilities as members of the ICT committee. Teachers should be trained in computer literacy skills so that they are in a position to carry out their own administration work in their free time.

4.8 Maintenance of computers in schools

How are the computers maintained at the school? Table 4.6 illustrates the different ways in which schools can maintain computers:

Table 4.6: How computers are maintained at schools

School	FHOR 1	FHOR 2	FMC	IS	FDET
Technical support	Friends, acquaintances and teachers	Friends, acquaintances and teachers		IT maintenance department	Rhodes IT Department
Payments for technical support/maintenance	Donations from friends	Donations from friends	ICT budget and fundraising initiatives	IT department at high school	ICT budget and fees from literacy classes

At least two schools, FHOR1 and FHOR2, do not have formal arrangements in place to maintain the computers. They approach friends and acquaintances to undertake the technical activities of upgrading the computers if there is a need. Most of these friends and acquaintances do not have formal training to upgrade the computers.

The FMC school has a budget, managed by the SGB, available to maintain the computers when there are major problems. For minor problems, the computers are maintained by means of funds generated from a computer club, which the computer coordinator has initiated. This money is also used to buy new software for the computer laboratory. Printing funds are also used to supplement the ICT budget for the maintenance of the computers.

The IS have their own maintenance department at their sister high school. The maintenance department is responsible for the maintenance of the computers for both the high and primary schools. They use a replacement system, whereby the school replaces old computers with new ones every four years.

The FDET school has a budget of about R5 000 per annum, taken from the school funds to maintain the computers. There is also an additional R2 500 set aside for the security system in the computer laboratory. The school charges a minimum fee of R50 per learner for computer literacy classes. This is to generate funds for the upkeep of these computers.

The evidence suggests that the FHOR1 and FHOR2 schools rely on friends and acquaintances to maintain their computers, while the FDET and the FMC schools have an ICT budget from the school funds as well as depend on fundraising efforts to upkeep their computers. The IS has its own maintenance department.

GDPS can follow these examples and maintain the computers through fundraising initiatives such as outreach programmes. This can include teaching computer literacy classes for the broader community at a minimum fee. The computer committee should draw up a fundraising programme each year for the maintenance of the computers and purchase additional items such as toner and copier paper.

4.9 Teachers' use of the computers

Do the teachers at the school make use of the computers/computer laboratory? This question was posed to the computer coordinator at each school. To amplify this issue, additional questions were asked: If teachers make use of the computers, in what ways are the computers used? Do teachers integrate the use of computers into their lessons? Are there any problems pertaining to the integration of computers into the curriculum? Table 4.7 illustrates how teachers at these schools utilize computers.

Table 4.7: The teachers' use of computers

FHOR1	FHOR2	FMC	IS	FDET
	Administration	• Administration • Computer skills teaching and training • Teaching and learning • Internet research		

Teachers do not make use of the computers at the FHOR1 school. The teachers at the FHOR2 school use the computers primarily for administration work, which is done with the help of the two IT coordinators at the school. These coordinators do the necessary administrative work for the school, such as designing reports, typing out teachers' class lists and examination papers, and other administrative work.

Each teacher at the FMC school has a computer installed in their classroom. This computer is used, with assistance from the ICT coordinator, to do specific tasks with the

pupils in the classroom. Teachers also use the computers for administration such as typing out test papers, examination papers and assignments. The computer laboratory is utilized for teaching computer literacy skills and to do research work on the Internet. For example, the geography teacher brings her class to follow the cyclones and the weather of South Africa on the Internet.

Teachers at the IS use their own computers at home to do administrative work. This gives them the necessary skills and confidence to integrate computers into the curriculum. The computer coordinator explains:

> Teachers must use computers themselves you know, they must use a computer to do worksheets, to … be creative themselves, so … you know… they need to have an understanding of computers.
>
> (IS ICT coordinator, 2004)

Teachers integrate ICT into the curriculum by teaching pupils to work on software packages like PowerPoint and Excel. In the junior primary section, the teachers use the computers for administrative purposes, but they feel they are lacking the necessary teaching skills when it comes to teaching computer literacy skills to the pupils (IS ICT coordinator, 2004). In addition, the teachers let the pupils work on applications such as *Word* and *PowerPoint*.

In order to find out in what ways teachers are skilled, the following questions were raised:

- How many teachers are skilled or unskilled in using the computer?
- How do teachers make use of the computers at the school?

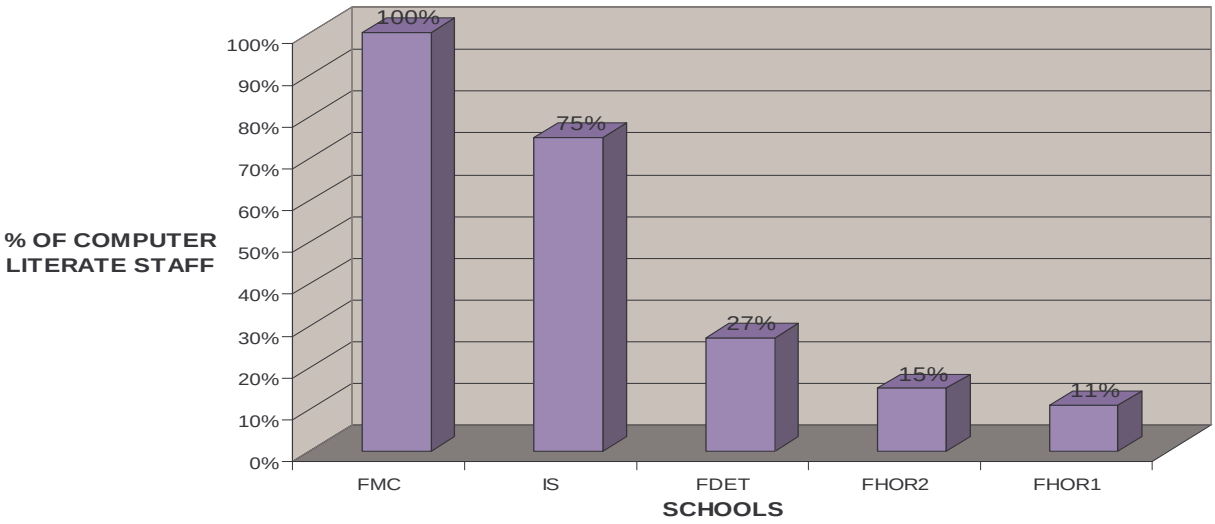


Figure 4.3: Percentage of computer skilled teachers

Figure 4.3 illustrates that the FMC has the highest number of computer skilled teachers, with 100% computer literate staff, while 75% of the staff members at the IS are computer literate. The FDET school has a 27% computer literate staff, followed by the FHOR2 school with a computer literate staff of only 15%. The FHOR1 school has the lowest percentage of computer literacy, with only 11% of its teachers being computer literate.

On the subject of programmes for teachers to become computer literate, the following questions were raised, as outlined in Table 4.8: Where did the computer literate teachers receive their training, and are there computer literacy classes for teachers at the school?

Table 4.8: Where and how do teachers receive computer training?

School	FHOR1	FHOR2	FMC	IS	FDET
Where did computer literate teachers receive computer training?	No formal training	Compulsory subject at college/university		Literacy classes at sister schools	World Bank; Metlink Project; SchoolNet (computer coordinator); Rhodes University
Are there formal computer training sessions at school?	No	No	No	Yes	Yes

The FHOR1 school does not offer computer lessons for teachers, but they are in the process of getting the computers up and running to achieve this goal. The computer coordinator at this school did not receive formal computer literacy training, but is a self-taught computer coordinator. The FHOR2 school does not have formal training sessions in computer literacy for teachers, but is planning to do so in the future. Likewise, there are no formal training sessions for teachers at the FMC school. All the staff members at the IS were initially introduced to computer literacy programmes on their computer network. Computer literacy lessons are offered for new staff members at one of the sister schools, and anyone is free to attend these lessons. The computer literate teachers at the FDET school received computer literacy training from projects such as the World Bank and MetLink Project, as well as from Rhodes University. The computer coordinator at the school offers additional computer literacy classes voluntarily and without compensation to staff members through a programme for teachers called Intel® Teach to the Future (Intel® in Education, n.d.). The teachers are tutored in applications such as *Word*, *PowerPoint*, Spreadsheets and Web Design.

It is evident from these results that computer literacy levels are the highest at schools where teachers make use of computers for teaching and learning. These schools are the

IS, FMC and FDET. The teachers at these schools received formal computer literacy training and are sufficiently skilled and knowledgeable to integrate computers into the curriculum. On the other hand, the schools where the teachers' computer literacy levels are the lowest, there is no ICT integration into the curriculum. The low computer literacy levels at these PD schools, FHOR1 and FHOR2, certainly may have had an adverse effect on teachers' ability to integrate computers into the curriculum. However, the exception is the FDET school. Although it is a PD school, it has successfully integrated computers into the curriculum despite its low level of computer literate teachers. This is an indication that, regardless of the low levels of computer literacy among teachers, ICT can still be integrated into the curriculum.

Teachers at four of the five participating schools did not receive formal training in computers, according to the data. The ECDoE is aware of the shortage of skilled teachers at schools in the Makana and Somerset East Districts. Recently, the ECDoE initiated a short course in basic computer skills training in Makana. This course, called the Introductory N4, was designed for teachers without basic skills in computer usage. It was very successful and the ECDoE sponsored it (Haarhoff, 2006).

GDPS, with a computer literate staff of about 80% and a computer laboratory with networked computers, is in a more favourable position than the FHOR1 and FHOR2 schools. Although many teachers at GDPS are skilled in the use of computers for administrative purposes such as typing, they can also utilize the computer laboratory to do Internet research for assignments and projects, as in the case of the FDET school. Teachers' use of the laboratory can be done under the supervision of the computer coordinator, who is usually a highly skilled user of the computer, as in the case of the FMC and the IS schools. Teachers can instruct the pupils themselves, while the coordinator only supervises. Furthermore, computer literate staff members can offer computer literacy courses to computer illiterate staff members at a minimum cost. The generated income from these courses can be used to maintain the computers.

4.10 Schools with Internet connection

Table 4.9 sets out which schools have Internet connectivity. It also shows who sustains the Internet connectivity at these schools.

Table 4.9: Schools with/without Internet connection

Schools	FHOR1	FHOR2	FMC	IS	FDET
Internet Connection	No	No	Yes	Yes	Yes
Sponsorship of Internet connection			Governing Body funds	Running expenses: Partnership with sister schools	Sponsor: Telkom Centre of Excellence with Rhodes University Education Department

There is no Internet connection at the FHOR1 school. This school initially had Internet connection sponsored by Telkom in 1997, but the Internet was discontinued after a year since the school could no longer afford the annual fee of R800 for Internet connectivity. The Internet connection for the FMC school is made possible with funds made available by the SGB of the school. The IS has a joint partnership with its sister high schools, and therefore Internet connection is made available to all of these schools. The FDET school receives sponsorship from the Telkom Centre of Excellence at Rhodes University to keep the school connected to the Internet.

As in the case of the FDET school, the Telkom Centre of Excellence at Rhodes University sponsored the connection and running costs of Internet connection at the school.

4.11 Community involvement

None of these schools were involved in formal community outreach programmes in computer literacy. The computer coordinators at the FHOR2 school assist members of the community by typing their documents such as CVs and letters on an *ad hoc* basis. The FDET school considered the problems it would create to involve the community through outreach programmes, and has therefore not embarked on such a programme. It was not clear from the interview what these problems entailed.

GDPS can consider offering sought-after computer literacy classes to the broader community at a minimum fee. The DoE supports the idea of community involvement in schools with computers such as providing computer literacy programmes to the broader community (DoE, 2004).

4.12 Private sector involvement

The private sector has not directly supported any of these schools to implement or maintain their computers. The FMC and the FDET are the only schools that have applied for, and received free computer software from Microsoft.

While the private sector has made a significant contribution to the implementation of the computers at GDPS, it is not certain that they will provide ongoing support for the maintenance of the computers. This option is worth considering in the future. Although GDPS has applied for free software from Microsoft, the school is still waiting for a reply.

4.13 Conclusion

This chapter has focused on the findings of the research by discussing the implementation of computers in schools. The chapter began by considering the strategies that the five schools that participated in the research employed to implement computers in schools, by referring in particular to the providers or donors of these computers. The chapter also focused on the individuals who initiated the process of acquiring computers for their schools. The next section discussed the number of computers in these schools, and went on to analyze how these computers are utilized and maintained in the schools. In addition, the chapter discussed how the number of computer skilled and unskilled teachers might have an impact on how teachers integrate or not computers into the curriculum. The importance of an ICT policy and the roles of the ICT committee and coordinator provided insight into the management of the computer. To conclude the chapter, I have compared the schools with and without Internet connection, and how connected schools can incorporate the community and private sector as additional sources of income to maintain the computers.

Chapter 5

5 Conclusion

5.1 Introduction

This chapter summarizes the main ideas from the research findings, and identifies the key issues that have limited the research. Furthermore, I provide recommendations regarding computer implementation and integration for George Dickerson Primary School (GDPS) based on the findings that were drawn from the research.

5.2 Summary of findings

This research has focused on the following main question:

What does the ICT practice in five primary schools in the Makana and Somerset East Districts of the Eastern Cape suggest about the implementation of ICT in a local primary school?

The primary concern of the study is to find out how networked schools and schools with stand-alone computers implement ICT, and to use these suggestions to inform ICT implementation at GDPS. I have identified eight main issues from the study that can be used to inform ICT development at GDPS. These issues are:

- Acquisition of computers;
- Implementation of computers;
- Maintenance of computers;
- Integration of computers into the curriculum;
- Teacher development;
- School ICT policy;
- Government/private sector involvement; and
- Management of computers or computer laboratory (ICT committee).

I provide a detailed summary on each of these issues in the following paragraphs.

5.3 Acquisition of computers

I was particularly interested to see how the five sample schools acquired their computers. The computer coordinators, who are also classroom-based teachers, from four schools in the Makana District and one school in the Somerset East District were interviewed. The responses revealed that their schools acquired computers in various ways. To clarify what methods these schools used to acquire their computers, I have divided the five schools into two categories: (1) three previously disadvantaged (PD) schools and (2) two previously advantaged (PA) schools. Two of the PD schools, the former House of Representative school 1 (FHOR1) and the former House of Representative school 2 (FHOR2), have employed only one method, namely donations, to acquire computers for their schools. On the other hand, the two PA schools and one PD school have employed more than a single method to acquire computers. The former Model C (FMC) school utilized school funds as well as leasing the computers as methods of acquiring the computers, while the former Department of Education and Training (FDET) school acquired theirs through Internet projects and a pupil competition. The Independent School (IS) bought their computers with school funds, through fund-raising efforts and a loan. The Department of Education (DoE) has neither provided nor attempted to provide support in any form in the acquisition of computers to any of these schools.

In addition to acquiring computers, I wanted to know who initiated the process of acquiring computers for their schools. The results revealed that in each school different individuals undertook this initiative. At two PD schools, FDET and FHOR2, champion teachers drove the project of acquiring computers. The previous school principal at the FHOR1 school initiated the process for the acquisition of computers. At the FMC school, the School Governing Body (SGB) initiated the project, while the parents took the initiative of implementing computers at the IS.

Interestingly, the school that employed the most methods to obtain computers for their school is the IS. The schools who have exploited the least methods are the FHOR1 and FHOR2 schools.

These different ways of acquiring computers provide some useful ideas to schools that want to acquire computers of their own. Despite the fact that none of the schools

received computers from the DoE, the initiatives of champion teachers, a school principal, the SGB and the parents at these schools were sufficient to obtain computers for their schools.

Although my school received its computers through donations, GDPS can consider various options to obtain additional computers. These options can include participating in projects and competitions through the Internet, engaging in fund-raising activities with the encouragement and cooperation of the SGB and dedicated parents of the school, as well as applying for donations on the Internet and the private sector.

I can therefore recommend to GDPS that it is essential that a person or group of people take the initiative to drive the whole process of acquiring additional computers for our school. A team of teachers, parents or the SGB with similar ICT skills or interests can be of assistance to this individual or group. As GDPS has already established a computer committee of five teachers chaired by one of the committee members, I recommend that this committee take the lead in the consummation of these various strategies that are identified in this study. The various roles of this committee will be summarized later in this chapter.

Ideally, the DoE should be approached to provide assistance and guidance to GDPS in the acquisition of additional computers for the school.

5.4 Implementation of computers

The results reveal that two PD schools, the FHOR1 and FHOR2 schools, were not utilizing their computers effectively, and thus do not integrate the use of computers into the curriculum. This means that computers are not used either as a “tool” (Taylor, 1980) to do projects or as a “tutor” (Taylor, 1980) to teach computer literacy skills, but primarily as a “toy” (Taylor, 1980) for learners to play games in their free time. The IS, FDET and FMC schools utilize their computers effectively. This means that computers are utilized to do educational projects, for example research on the Internet (tutor), or to teach literacy skills to the learners and teachers (tool).

But why do some schools utilize their computers effectively? To answer this question, key aspects that pertain to computer implementation at these schools will be carefully

considered. These aspects are: geographical location of the schools, support structures, computer literacy levels among staff members, computer facilities and timetabling.

Geographically, two PD schools, the FHOR1 and FHOR2 schools, are situated outside the borders of Grahamstown in the Eastern Cape; one school being in Port Alfred in the Makana District and the other school in Adelaide in the Somerset East District. They are also situated in the disadvantaged areas of their respective towns. These schools enjoy limited or no support in the form of maintenance of computers, sponsoring of hardware and software, or training of teachers from the parents or the SGB. Neither do they have the support of Non-Governmental Organisations (NGOs), tertiary institutions or private sector companies.

In contrast, the three schools that are utilizing their computers effectively, the IS, FDET and the FMC schools are all situated within the city of Grahamstown. This situation is especially significant, because many support structures are located within Grahamstown.

This means that they have the support of the parents, SGB, the private sector or tertiary institutions to incorporate ICT into their curriculum. The FMC and the IS both have supportive parents to help them with the implementation process. The IS operates in collaboration with their sister schools, while the FMC school has a supportive SGB to help fund the implementation of computers. The remaining PD school, the FDET school, enjoys support from a tertiary institution for the upkeep and maintenance of their computers.

Computer literacy levels among teachers at the five schools vary, according to the research data. Very few of the teachers at the two FHOR schools have ICT skills to teach computer literacy or incorporate ICT into their curriculum. They also do not have formal programmes for teachers and learners to improve their computer skills. In contrast, most of the teachers at the IS and FMC school are computer literate, although computer literacy is minimal among teachers at the FDET school. The latter school has incorporated an in-service training programme for teachers in the use of ICT skills.

The low or deficient computer literacy levels at the two FHOR schools may have inhibited the integration of ICT into the curriculum. In addition, computer facilities are

minimal or are lacking at the two FHOR schools. Many computers are outdated or in disrepair. These schools also lack computer laboratories. The FMC, IS and FDET schools have well equipped computer and networked laboratories that are utilized effectively. It is also at these schools that effective ICT integration into the curriculum occurs.

The data also reveals that timetabling is necessary for effectively integrating ICT into the curriculum. While the IS and the FMC schools have formal timetables and booking systems in place to ensure ICT integrating into the curriculum, the FHOR schools do not have formal timetables or booking systems. At FHOR1, any pupil is free to use the computers for educational games under the supervision of a teacher.

While these poorer schools do not use computers effectively due to old computers, a lack of funds and adequate support from the parents, among other reasons, the non-integration of ICT into the curriculum at GDPS can also be attributed to the same reasons as the FHOR1 and FHOR2 schools mentioned above.

Firstly, GDPS is a poor school with a poor learner base, in much the same way as the FHOR and FDET schools. As a result, GDPS does not have sufficient funds to maintain the computers, nor can the school depend on the support of the parents or the SGB. Alternative approaches need to be explored as a support mechanism to maintain the computers so that curriculum integration of ICT can take place. One such approach is to rely on the support of NGOs, the private sector, as well Rhodes University, who initially sponsored these computers at the school. Unlike the FHOR schools, GDPS is ideally situated in Grahamstown, as in the case of the IS and FMC school and especially the poor FDET school, as support is conveniently accessible.

Secondly, without adequately trained teachers in ICT and computer skills, the utilization and integration of ICT into the curriculum might be minimal. Research has shown that teachers who do not have adequate skills in ICT might not use ICT for curriculum integration (Pelgrum, 2001). At GDPS, one encouragement is that many teachers have at least basic ICT and computers skills, but most of them use their computer skills only for administrative purposes. More needs to be done to encourage teachers to integrate computers into the curriculum, such as stimulating their interest to use the Internet as a

source of learning and teaching, and to integrate the use of computers into the curriculum as a source for both teachers and pupils.

Finally, GDPS lacks a formal timetable to facilitate the integration of ICT into the curriculum. To avoid clashes regarding the use of the computer laboratory, a carefully constructed timetable needs to be developed to allow all the classes to utilize the laboratory adequately.

5.5 Maintenance of computers

A question regarding the maintenance of computers elicited various responses from the participants. The two FHOR schools do not maintain their computers adequately. Instead, they rely on unqualified or under-qualified teachers, friends and acquaintances to maintain their computers. By contrast, the FMC school maintains their computers through the school funds as well as teacher initiatives by teaching computer skills to interested pupils at a minimal fee. The IS has their own maintenance department that ensures that their computers are regularly maintained. The FDET school has limited school funds available for the upkeep of the computers. These funds are also supplemented, as is the case of the FMC school, by teacher initiatives.

The results show that there are various ways to maintain the computers. It is interesting to note that some schools use alternative ways to acquire funds for the maintenance of their computers, for example by teaching extra lessons to interested pupils at a minimal fee. GDPS can follow this example. Apart from making school fees available for the upkeep of the computers, qualified teachers at the school can teach computer skills to members of the public at a minimal fee, as encouraged by the DoE (DoE, 2004). While some schools rely on unqualified or under-qualified people to maintain the computers because of limited funds, this needs to be avoided at GDPS. The danger is that unqualified people do not have the necessary skills to maintain the computers adequately.

5.6 Integration of computers into the curriculum

The following question arose: how, if ever, are the computers utilized in these schools? The data that emerged from of the research revealed that the FHOR1 school does not

have functional computers, and therefore does not use the computers for teaching and learning or for any other purpose. The FHOR2 school uses their functioning computers for teaching and learning through educational games, although they do not have a formal computer laboratory in their school. However, some functional computers are also utilized for administrative purposes. In contrast, the remaining three schools in the Makana District, the FMC, FDET and IS utilized their computers for teaching and learning, to develop the learners' and teachers' ICT skills, to carry out educational projects, to employ the Internet as a means of communication and Internet research as well as curriculum integration, and to utilize the computers for administration. Conveniently, all these schools have access to the Internet to support successful ICT integration into the curriculum. Teachers at these schools use the computers for teaching lessons and computer skills, for their own purposes such as typing assignments, and for administrative purposes such as typing lesson plans and examination papers.

The Internet at GDPS can be used for teaching and learning such as communication (e-mail), projects as well as research. Educational games can also be used to integrate ICT into the curriculum. Reliance on the Internet as the only way to integrate ICT into the curriculum needs to be avoided. Learners and teachers should be encouraged to use applications such as *Word* to type assignments, spreadsheets to work out formulas, especially in mathematics, and slide shows to present data from research projects.

5.7 School ICT policy

On the issue of whether a school policy in ICT contributes to the successful utilization of ICT, the following results were analyzed from the research. Only two of the five schools had formulated ICT policies when I interviewed the ICT coordinators. They are the FDET school and the IS. I managed to obtain a copy of the policy only from the FDET school. At these schools, ICT is integrated into the curriculum to some extent. At the FDET school for example, the ICT policy helps to eliminate complications resulting from the use of the computer laboratory by following strict rules so as not to disadvantage other classes or individuals who may want to use the laboratory for other purposes. In the case of the IS, there are protocols to follow as part of the ICT policy, and these protocols are strictly adhered to.

This evidence suggests that an ICT policy is essential in the setting up of rules and regulations to ensure the smooth functioning of ICT integration into the curriculum. GDPS has yet to draw up a policy that would include how classes are to use the laboratory, which protocols to follow when transgressions occur, and how the computers are to be maintained. The computer committee of the school, together with all the stakeholders that include the SGB and teachers, should draw up this policy.

5.8 Government/private sector involvement

Concerning government intervention, the results do not reveal any involvement or support in acquiring or maintaining the computers in any of the schools. The non-support of the Government is in contrast to the goals of the Government as outlined in the White Paper for e-Education (DoE, 2004:29): "National and provincial managers and administrators must plan and mobilize funds for provincial, district and institutional resources to support hardware and equipment installation, as well as maintenance and repair thereof". The Eastern Cape (EC) ICT policy reiterates this view that mechanisms need to be developed in order "to ensure that support and maintenance is provided to the schools with ICT" (ECDoE, n.d.: 9). The DoE should be encouraged to support schools.

The private sector, according to the results, is also not involved in supporting these schools. However, two schools, the FMC and the FDET schools, have applied for and received free software from a software company.

Government support is essential to successfully integrate ICT into the curriculum, especially for poor schools, and more should be done from a governmental point of view in order to assist GDPS to acquire hardware and software and to maintain the computer laboratory at the school. This support can be in the form of financial assistance to the school and the availability and support of skilled ICT professionals to maintain the computers and train the teachers in computer skills. Fortunately, the DoE has recently initiated the training of teachers in basic computer skills in the Mkana District. This initiative by the DoE can be useful at schools with computers or computer laboratories, like GDPS, but ineffectual at schools without computers.

Free software is readily available from software companies, and GDPS can acquire software by applying for it from the various companies.

5.9 Management of computers or computer laboratory

I was interested in how these computers or computer laboratories are managed at the various schools. Interestingly, most of these schools have at least one computer coordinator who acts as the overseer/s of the computers or computer laboratory, while the FHOR2 school has two coordinators. The main task of these coordinators is to ensure that the computers are adequately administered. Their specific tasks include the opening and locking up of the computer laboratory, liaising with the SGB and maintenance managers regarding problems and needs for the computer laboratory, as well as the teaching of computer literacy skills. In addition to the computer coordinators, only three schools, the IS, the FDET and the FHOR2 have computer committees in place. These committees consist of usually not more than ten members of staff, and their primary function is to assist in the managing and maintenance of the computer laboratory.

As it is important that the ICT laboratory at a school is adequately managed, GDPS has established an ICT committee. These committee members each have a portfolio such as coordinator, supervisor, fund raiser, ICT specialist and maintenance manager. While the computer committee at GDPS has been successful with the implementation process, they should also be able assist in the managing and maintenance of computers at GDPS as well as assisting teachers who want to use the computer laboratory.

5.10 Limitations of the study

Although the sample was small, I feel that the issues that are discussed here are probably relevant to most schools with computers or computer laboratories. However, had the sample size been bigger, I would have had a wider and more comprehensive account of the issues under discussion. This could not be accomplished due to the scarcity of schools with computers in the Grahamstown area, the distances between the schools with computers within the Makana District and the lack of funding to make it possible to reach these schools.

Documents about ICT in education were most notably found in First-World countries such as Great Britain, the Netherlands and Norway. However, I was not able to find as much information about the use of computers in education in Third World countries,

especially in African countries like Ghana. This has made the study very challenging because I could not adequately compare the state of ICT in developing countries to that of developed countries.

The research was further hampered by interruptions, prompting me to discontinue the research at times. These interruptions, which included facilitating the Revised National Curriculum Statement (RNCS) programme for the Department of Education at various schools, inadvertently had a detrimental effect on the completion of the thesis in time. Follow-up interviewing was difficult, as interviewees did not want to avail themselves for a second interview because of their busy schedules. Moreover, it was difficult to communicate with the FHOR schools because of their geographical location and the unavailability of the Internet at these schools.

5.11 Conclusion

This chapter has deliberated on the implementation of computers in schools, and the various ways a school can undertake to acquire computers for their school. In particular, the chapter has focused on issues such as managing and maintenance of the computers, ICT integration into the curriculum, the importance of an ICT policy, as well as governmental and private sector support in the implementation process. These suggestions were than synthesized with a view to provide GDPS with suggestions on how to implement computers in school.

Finally, the recommendations suggested in this chapter are appropriate for GDPS, and schools in similar situations as GDPS, to facilitate ICT implementation and integration of ICT into the curriculum.

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Appendices

Appendix A

George Dickerson Primary Proposal

Dear Sir/Madam

30 May 2002

I would like to make use of this opportunity to ask for your assistance in sponsoring our school with a few much-needed computers to be used for educational purposes. The following background of the school might serve as an expansion to my application.

A focus on George Dickerson for the implementation of computers at the school.

Context of the school

The school is situated in the 'Coloured' township of Grahamstown. It is a multi-cultural school where about 900 Xhosa and Afrikaans learners are taught, with 24 Afrikaans and Xhosa teachers. The language policy of the school is English and Afrikaans. Grades one up to seven are offered, and Outcomes Based Education is taught throughout. The school offers the following learning areas, as per Government Policy: Literacy, Mathematics, Technology, Arts and Culture, Human and Social Sciences, Natural Sciences, and so on. With limited sports equipment and fields, the school can only offer a few sports, like netball, rugby (played on a public sports field) and mini –cricket. From a cultural perspective, the school participates in choir competitions and local Eisteddfods.

Rationale for applying for sponsorship

The community where the school is situated is marked by unemployment and poverty. Most parents of the school cannot afford to pay the school fees, which are set at one hundred rand per pupil per year. The only income where the school can 'survive' on a daily basis is generated by the tuck shop. It is therefore necessary to apply for sponsorship, because the school cannot afford to pay for the computers by itself.

Current computer facilities

Capacity

The school has a specially installed computer room that can accommodate approximately 15 – 20 computers. There are tables and chairs where these computers are standing on. These tables are at the moment occupied by about 9 old and obsolete computers. These computers have been sponsored to the school by Rhodes University a few years ago. They are very old Apple computers that cannot be utilised anymore because of the cost for repairing the computers. Another reason is that Apple computer parts are very scarce and expensive. There is specially installed cabling for the use of the Internet. But without functioning computers the computer room is ineffective. There is only one other computer in use, and this computer is located in the secretary's office. The only printer, a dot matrix printer, has been sponsored to the school.

Security

Security for the computers is adequate. Burglar bars for the windows and the door have been installed a few years ago. There is an alarm system, Hi-Tech, connected to the computer room. A teacher, who will be part of a whole

committee, will be responsible for the supervision and maintenance of the computer room. This committee will be discussed under ‘maintenance’.

Maintenance

Generated Income

A while ago, the school has conducted some research among parents, and found that there is currently a great demand for computer literacy among parents. The literacy levels in basic computers, like word, among teachers are about 80%. Given these reasons, the school can offer extra-mural computers lessons to the wider community for a minimum fee. The generated income can be used to maintain the computers on a monthly basis. Furthermore, the tuck shop can be expanded, and the extra money be used to maintain the computers. A management committee (discussed below) will be responsible to generate funds on a monthly basis for the maintenance of the computers.

Computer Committee

There will be a committee of about 5 people that will be responsible for the maintenance of the computers. The committee will consist of the following portfolios:

- A Person in charge: will be responsible to oversee the whole process; that is he/she will be in charge of the Computer Room in general. This person will preferably be a qualified IT teacher.

- A Fundraiser: this person, together with the rest of the staff, will be responsible for the generation of income as a means to maintain the computers. The generated income will be used to renovate the computers on a regular basis. The money will also be used to obtain software, printing paper, and computer peripherals.

- A Scheduler: this person will be responsible to work out schedules for the use of the computer room. For example, the person will be responsible for a timetable and will make sure that everyone adheres to the timetable. Everyone who wishes to make use of the computer room outside the scheduled time must consult with this person. Security for the computer room will also be the responsibility of this person.

- Inventory: this person will be responsible for the purchase and upkeep of new programmes and peripherals. The person will also be responsible for the inventory of all the hardware and software in the computer room, for example monitors and printers. This equipment must be regularly checked and the results must be handed to the whole committee on a regular basis.
- Specialised IT teacher: this person will be in the computer room all the time, because no unsupervised access to the computer room will be allowed. This person will be a specialist in Information Technology and

will be responsible to teach computer literacy skills to the learners and to the rest of the staff. This person will also be responsible for computer literacy programmes to the broader community. Because of the huge task that this person has, s/he will be responsible to work out a programme in liaison with Rhodes University for the teaching of computer literacy skills.

The committee will meet on a regular basis to monitor and evaluate the progress, if any, made with regard to the whole process. The committee will also write up a report once a term, and maybe once a year, to be sent to the sponsors of the computers. The SGB will also be enlightened about the process.

The cleaning of the computer room will be the responsibility of the cleaners at the school.

Why the school needs computers

The advantages for the use of computers at the school will be the following:

For learning

- At a multi-lingual school, where the learners' first language is not English, but where they learn through the medium of English, the computers can help the learners to improve on their English. Using a spell checker in a simple application such as a word processor, the learners may improve their English skills.
- Considering the number of pupils that need extra attention, the computer may help the 'slow' learner to improve because the teacher can spend a little more extra time on the slower learners, leaving the faster learners to work on their own pace.
- The Internet can help learners to do research and assignments under the supervision of the IT teacher. Up-to-date information can be accessed rapidly, and this will keep the learner as well as the teachers across all the

learning areas informed. In this way, teachers may find the Internet very helpful as a resource for their specific learning area.

- The learning of ICT skills can

Approach

- Constructivist principles can be applied in the computer classroom. The teacher will act as a facilitator, leaving the learner to work on his/her own pace. The learner can learn a lot of skills (working with the computer), attitudes (working on her/his own) values (tolerance towards other cultures) and of course knowledge.
- Co-operation is encouraged, where the learners help each other with tasks and assignments. The learners can also act as facilitators, by helping and scaffolding other 'slower' learners.

Considering the above-mentioned, I would be most grateful if you would consider this application in a most favourable fashion. I trust and hope that the application succeeds.

Thank you very much.

Gilbert Prince

(Teacher: George Dickerson Primary)

Appendix B

Interview schedule: EC District ICT coordinator

Interviewer: Gilbert Prince (Master Student – Rhodes University)
Interviewee: EC District ICT Coordinator, Eastern Cape
Tool: Tape recorder

- The South African Departments of Education and Communications have a policy document (2001) in place outlining the strategy for ICT implementation in education. This policy maintains that over 90% of schools in the Eastern Cape are without computers, in comparison to 58,6% in Gauteng and 54% in the Western Cape. What, in your view, is the reason(s) that so many schools are without computers in the Eastern Cape?
- Do you know how many former 'Model C' primary schools have computers in the Eastern Cape? How many 'previously disadvantaged' primary schools in the Eastern Cape have computers? If not, do you know where I could find out?
- What is the Eastern Cape government's position concerning ICT implementation in schools, especially primary schools?
- There are a number of computer projects in other provinces that provide Internet connectivity to schools in their respective provinces. These projects are either government funded or are private initiatives. Examples are the 'Blue IQ Project' in the Gauteng Province and the 'Khanya Project' in the Western Cape. Initial research by myself has revealed that no such projects exist in the Eastern Cape. Are you aware of such projects in the Eastern Cape? If there's no such policy, why do you think that this is so?
- How does the government in the Eastern Cape collaborate with the private sector to ensure computer implementation in schools?
- What structures have been put in place to support schools wanting to implement computers?

- Are you aware of funding for computers that is intended for schools in the Eastern Cape? What procedures need to be followed to access this funding?
- Are you aware of any maintenance contracts that have been approved by the Eastern Cape government to maintain computers in schools?

Appendix C

Correlating main ideas from interviews

1. **How did your school go about obtaining computers? Was it through donations, fundraising efforts or other strategies?**

Port Alfred: Firstly, there was a project at school. That was uhm… Mr Ed Catmaas? was the head of that project. Uh… so that was … he brought computers, but it just went offline and most of the computers was donated from overseas sponsorships … sponsors.

Who was the initiator … initiators of these sponsorships?

As I know, the previous principal, he was … he was the one that …

But you … you taught here when he …

Ja.

… when the computers came to school. So it was through the initiation of the previous principal?

Previous principal.

Adelaide: Through donations, yes. (Long pause). Er … We received a few from … the main computer was donated by Telkom. Telkom donated it. One computer was donated by an ex pupil. The other computers were … the other computers were donated by Rhodes.

Victoria Primary: No, the Governing Body.

Was … were there donations? Did the Governing Body …

There were no donations. The Governing Body bought them. They hired them out and paid them over three years or something.

Where did they get the money for that?

I don't know. (*laughing)* I've got no idea but they … they didn't buy them out right there they got some hire purchase lease … I don't know if you have heard of those agreements where you can pay them off over two or three years.

Prep: Well, there is that huge amount of fundraising, 'cause it's cost us in the region of a hundred and fifty, a hundred and sixty thousand rand to get our lab up and running. And, so the money was raised by the parents through various fundraising activities.

How long did that take?

That took about a year, it was intensive fundraising, uhm … and we put our new lab in I think it's now three four years old, and they are due to have new machines next year. So we work on a rotation system the funding uhm … has been provided by the Independent Schools Council uhm… which we will pay back. But the money is there for us to replace our computers every four years, to upgrade. So …

Nyaluza: OK, briefly. Uhm … it started with the 'Khula' Project. Uh… when the 'Khula' Project, which was funded by **Lucent**? Technologies, invited four teachers to join the training at Rhodes University, they offered us four computers after training. The four teachers each brought to the school the computer they had trained on

Ja. Now that was a project that … almost every project that was advertised by SchoolNet SA, we participated. We were invited to participate in Scifest 2000. Er… we sent four students, who participated and finished.

One of our students was the first one to complete constructing a bridge. They were trained on one of the programs called “Bridge Builder” and he constructed a bridge, when he animated the truck, his was the first one to cross the bridge. So we got an additional computer for that. He is such a good boy - he is now at the University of Cape Town doing actually computer science.

And it was through Cheryl that you got the rest of the computers.

No! It was through my effort… mm … hard work actually. Cheryl introduced me to SchoolNet. They came during Scifest 1999. I was already her student.

Appendices D1 – D4

Semi-structured interview schedules

D1

Interviewer: Gilbert Prince (Master Student – Rhodes University)

Interviewee: Acting principal – FHOR school 1

Tool: Tape recorder (if preferred)

Date & Time: 12 March 2004, 15h00

Type of interview: Semi-structured interview

Type of school: Former 'disadvantaged' school

If the computer room is utilized, the following questions are relevant:

- How did your school go about obtaining computers? Was it through donations, fundraising efforts or other strategies?
- Does your school have an ICT policy in place? To what extent has this policy guided the implementation of computers in your school?
- What do you use the computers for at the school?
- How do you maintain the computers? Do you collaborate with the private sector to help with the maintenance of the computer laboratory? How?
- What support have you received from Government?
- Do you have an ICT/IT committee in place? What are their functions/roles? Who is represented on it?
- What is the role of the ICT coordinator at the school? (*If answer to no. 6 is no!)*
- Do the teachers at the school make use of the computer room as a teaching resource? To what extent, if any, are these teachers integrating computers into the curriculum? If yes, are there any drawbacks/advantages that occur as a result of curriculum integration of computers?
- Roughly what percentage of members of staff is skilled in using the computers, and what percentage is unskilled? Do you have computer courses and programmes in place to uplift teachers' skills in computer use?

How well are they attended? Does the fact that teachers are unskilled/skilled in the use of computers have a significant impact on them making use of computers as a teaching resource?

- Do you have a timetable for the use of the lab in place? How well does it work?
- Do you have computer literacy programmes in place for the broader community? If yes, how well do they work?
- What was the role of the parents in the computer implementation process?
- Do you have protocols in place to prevent children/adults from downloading 'unacceptable' material from the Internet?
- To what do you contribute the success (or otherwise) of the implementation of computers in schools?
- Does your school have a replacement policy for computers?

<u>If the computer room is not utilized, the following questions are relevant:</u>

- How many computers do you have at the school?
- How did your school go about obtaining computers? Was it through donations, fundraising efforts or other strategies?
- What was the purpose for obtaining computers for the school?
- What was the role of the Government in the implementation process?
- What are the reason(s) for not utilizing the computers?
- Even if you do not utilize the computers at the school, do you maintain the computers? If yes, how? Do you collaborate with the private sector to maintain the computers? If no, why not?
- Roughly how many members of staff are skilled in using the computers, and how many are unskilled? Where did the skilled members get their computer training?

<u>Interviewer</u>: Gilbert Prince (Student – Rhodes University)

D2

Interviewee: Computer lab coordinators – FHOR school 2

Tool: Tape recorder (if preferred)

Type of interview: Semi-structured interview

Type of school: Former 'disadvantaged' school

Type of school: Former 'disadvantaged' school

- How many computers do you have?
- How did your school go about obtaining computers? Was it through donations, fundraising efforts or other strategies?
- Does your school have an ICT policy in place? To what extent has this policy guided the implementation of computers in your school?
- What do you use the computers for at the school?
- How do you maintain the computers? Do you collaborate with the private sector to help with the maintenance of the computer laboratory? How?
- What support have you received from Government?
- Do you have an ICT/IT committee in place? What are their functions/roles? Who is represented on it?
- What is the role of the ICT coordinator at the school? (*If answer to no. 6 is no!)*
- Do the teachers at the school make use of the computer room as a teaching resource? To what extent, if any, are these teachers integrating computers into the curriculum? If yes, are there any drawbacks/advantages that occur as a result of curriculum integration of computers?
- Roughly what percentage of members of staff is skilled in using the computers, and what percentage is unskilled? Do you have computer courses and programmes in place to uplift teachers' skills in computer use? How well are they attended? Does the fact that teachers are unskilled/skilled in the use of computers have a significant impact on them making use of computers as a teaching resource?

- Do you have a timetable for the use of the lab in place? How well does it work?
- Do you have computer literacy programmes in place for the broader community? If yes, how well do they work?
- What was the role of the parents in the computer implementation process?
- Do you have protocols in place to prevent children/adults from downloading 'unacceptable' material from the Internet?
- To what do you contribute the success (or otherwise) of the implementation of computers in schools?
- Does your school have a replacement policy for computers?

D3

Purpose of the study

I am currently a Master of Education (ICT) student in my final year at Rhodes University. My research topic is the implementation of computers in schools, especially primary schools. My research topic was prompted by the fact that our school received a donation of a few computers from Rhodes University, which enabled us to put up a computer laboratory at the school.

This study will enable me to find out how and why computers are utilized in other institutions, what the roles of the private sector the Government are, and how these inputs can inform the computer implementation process at our school, especially with regard to the formation of a computer policy for the school.

Interviewer: Gilbert Prince (Master Student – Rhodes University)
Interviewee: Computer lab coordinators – FMC school and IS
Tool: Tape recorder (if preferred)
Type of interview: Semi-structured interview
Type of schools: Former 'Model C' school and Independent school

- How did your school go about obtaining computers? Was it through donations, fundraising efforts or other strategies?
- Does your school have an ICT policy in place? If yes, to what extent has this policy guided the implementation of computers in your school?
- What do you use the computers for at the school?
- How do you maintain the computers? Do you collaborate with the private sector to help with the maintenance of the computer laboratory? How?
- What support have you received from Government?
- Do you have an ICT/IT committee in place? What are their functions/roles? Who is represented on it?

- What is the role of the ICT coordinator at the school? (*If answer to no. 6 is no!)*
- Do the teachers at the school make use of the computer room as a teaching resource? To what extent, if any, are these teachers integrating computers into the curriculum? If yes, are there any drawbacks/advantages that occur as a result of curriculum integration of computers?
- Roughly what percentage of members of staff is skilled in using the computers, and what percentage is unskilled? Do you have computer courses and programmes in place to uplift teachers' skills in computer use? How well are they attended? Does the fact that teachers are unskilled/skilled in the use of computers have a significant impact on them making use of computers as a teaching resource?
- Do you have a timetable for the use of the lab in place? How well does it work?
- Do you have computer literacy programmes in place for the broader community? If yes, how well do they work?
- What was the role of the parents in the computer implementation process?
- Do you have protocols in place to prevent children/adults from downloading 'unacceptable' material from the Internet?
- To what do you contribute the success (or otherwise) of the implementation of computers in schools?
- Does your school have a replacement policy for computers?

D4

Interviewee: ICT coordinator – FDET school

Interviewer: Gilbert Prince

Tool: Tape Recorder

- How did your school go about obtaining computers? Was it through donations or fundraising efforts?
- Does your school have an ICT policy in place? If yes, may I have a copy? If no, why not?
- What do you use the computers for at the school?
- How do you maintain the computers? Do you collaborate with the private sector to help with the maintenance of the computer laboratory? How?
- What is the role of the ICT coordinator at the school?
- Roughly what percentage (if possible) of members of staff are skilled in using the computers, and what percentage are unskilled? Do you have computer courses and programmes in place to uplift teachers' skills in computer use? Does the fact that teachers are unskilled/skilled in the use of computers have a significant impact on them making use of computers as a teaching aid?
- Do the teachers make use of the computer room as a teaching aid? Are there any drawbacks/advantages that occur as a result of curriculum integration of computers?
- Do you have a timetable for the use of the lab in place? How does it work?
- Dou you have computer literacy programmes in place for the broader community? If yes, how does it work?
- Were the computers sponsored or did the school purchase them?
- What was the role of the parents in the computer implementation process?
- Do you have protocols in place to prevent children/adults from downloading 'unacceptable'material form the Internet?

Appendix E

Invivo Coding

How did the school obtain computers?	PA	A	VP	Pr	N	TOT
Donations	x	x				2
Fundraising - Governing body			x	x		2
Social Responsibility Project					x	1
Fundraising - Parents				x		1
Pupil competition					x	1
What I am not finding here will lead to literature findings.						
Where did the computers/funds come from?						
Overseas companies (e.g. Lucent)	x				x	2
Local company (e.g. Telkom)		x				1
SA university (e.g. Rhodes, Stellenbosch)		x			x	2
SchoolNet					x	1
School Governing Body			x	x		2
Parents				x		1
Ex-Pupil		x				1
Independent Schools Council				x		1
Khula Project					x	1
Global Planet Project Competition					x	1
Who initiated the process of obtaining the computers?						
Principal	x					1
Rhodes University Education Department (Sheila Sisulu)					x	1
Governing Body			x			1
Teacher (Champion)		x			x	2?
Parents through fundrasing activities				x		1
How many computers does your school have?						
Less than five						0
Between five and ten		x				1
Between ten and twenty	x				x	2
More than twenty			x	x	x	3
Does your school have an ICT policy in place?						
Yes				x	x	2
No	??	x	x			3?
Why do you have an ICT policy in place? How well does an ICT policy work?						
As a guide for teachers					x	1
Reduce problems (e.g. when to use the lab)					x	1
"Acceptable Users Policy" as a guide for pupils on how to use the lab/computers				x		1
What are the uses of the computers at school?						
Administrative purposes	x	x		x		3
Teaching and learning in the classroom e.g Internet, projects etc.		x	x	x	x	4
Teaching and learning & computer skills through lessons			x	x	x	3
In-service training for teachers through projects (e.g. Khula, World Bank)					x	1
Computer studies – outreach programs						0
How are the computers maintained?						
Through acquaintances	x	x				2
Insurance/warranty			x			1
Through school funds					x	1
Teacher initiatives		x	x			2
Governing Body Funds			x			1
IT Maintanance Department from St Andrews				x		1
	PA	**A**	**VP**	**Pr**	**N**	**TOT**
Do you have an ICT committee in place?						
Yes		x		x	x	3
No	x		x			2
Joint IT committee with sister schools				x		1
How many members are represented on this ICT committee?						
5 - 10 members		x				1
10 - 20 members					x	1

Appendix F

The computer committee at GDPS

Above: A section of George Dickerson Primary School.

The Computer Committee members at GDPS

Melville Meiring:	Supervisor
Malcolm Douglas:	Equipment Manager
Lorraine Peters:	Fundraiser
Gilbert Prince:	IT Specialist