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**Factors enabling and constraining ICT implementation in  
schools: A multiple case study of three secondary schools  
in Lesotho**

A thesis submitted in fulfillment of the requirements for the degree of

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## **ABSTRACT**

This study focused on the implementation of ICTs in secondary schools in Lesotho. The main question addressed was: What are the enabling and constraining factors in the implementation of ICTs in schools? The work was undertaken in recognition of the fact that schools in the country were autonomously acquiring computers and using a variety of curricula without much coordination and policies from the government. There were factors encouraging schools to delve into this educational change: and challenges were already evident. This required further investigation.

The research approach commenced with a critical review of the literature. Literature was drawn from developed and developing countries in order to understand the process of ICT implementation from a variety of contexts. The enquiry about the implementation process in all the countries focused on the rationale behind the use of ICTs in schools. ICT policies guiding implementation, principal leadership, teacher professional development and ICT resources. The literature review was followed by case studies of three secondary schools in Mafeteng district in Lesotho. Using both qualitative and quantitative methods of research, the study sought to determine from key people in three case study schools their overall understanding of how the process of implementation was carried out and what they perceived as enablers and constraints.

The findings revealed that planning, access arrangements, training, support and to a lesser extent resources played a role in either impeding or encouraging the key ICT implementers at school and classroom level. Additionally, the key role of the principal and the MoE were highlighted in the study.

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## LIST OF ABBREVIATIONS

ANR	Australian National Report
ASPnet	The Associated Project network
BECTA	British Educational Communications and Technology Agency
CAD	Computer Assisted Design
CAI	Computer Assisted Instruction
DoE	Department of Education
GoL	Government of Lesotho
Govdoc	Government document
ICT	Information Communications Technologies
ICT4AD	Information Communication Technology for Accelerated Development
IFAP	Information For All Programme
ILS	Integrated Learning Systems
ISTE	International Society for Technology in Education
LTM	Long Term Memory
MoE	Ministry of Education
NCDC	National Curriculum Development Centre
NCLB	No Child Left Behind
NEPAD	New Partnership for Africa's Development
NETS	National Education Technology Standards
NGfL	National Grid for Learning
Ofsted	Office for Standards in education
SAIDE	South African Institute for Distance Education
SES	Social Education Standard
STM	Short Term Memory
UNESCO	United Nations Educational, Scientific and Cultural Organisation

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# Chapter 1: Overview of the Study

## 1.1 Introduction

Recent advancement in information, computing and communication technologies has necessitated the introduction of ICTs in all spheres of life including education. The term ICT is an abbreviation for Information Communications Technologies and it is a term used “to denote the whole range of technologies associated with processing information on the one hand and, on the other, with sending and receiving messages” (UNESCO, 2005:10). In the Lesotho ICT Policy document ICT is defined as “the convergence of communications, computing and information technologies” (Lesotho, Government Documents [Govdoc], 2005:29). In most schools in Lesotho, recent communication and information technologies such as the Internet and the World Wide Web are very rare but computing technologies for processing information are found in approximately 30 percent of secondary schools and approximately 25 percent of these schools are equipped with computer laboratories as well (Nketekete, 2006). Acquisition of computers by schools has not involved the government for many years; it has been occurred through donations, hiring and purchase by schools. Government involvement has been observed only recently.

The recent introduction of computers into schools in Lesotho by the government through the New Partnership for Africa’s Development (NEPAD) Initiative in 2005 and the realisation that their implementation strategies, although supposedly planned and implemented by experienced ICT in education experts had drawbacks, triggered my interest in investigating ICT implementation issues. The NEPAD Initiative mishaps (Z. Dlangamandla, NEPAD’s Country Liaison Person, personal communication, December, 2005), the haphazard introduction of computers into schools in the country (Kebede, 2006:2), and my initial research into the field strengthened my curiosity. In my initial reading on the implementation of ICTs in schools, I often encountered statements that many schools and governments were investing heavily in ICTs despite the fact that there were marginal benefits from using the technology (Hokanson & Hooper, 2000; Jonassen, 1994; Sutherland et al., 2004). It is in the light of what was observed in Lesotho and these statements that reiterated uncertain benefits of ICT in schools that I decided to delve into a study to investigate the enabling and constraining factors in the implementation of

ICTs in Lesotho schools. Hopefully, prior research on implementation strategies in other contexts and the identification of enablers and constraints identified in Lesotho schools could inform further ICT implementation plans in Lesotho.

Pelgrum and Law advise that "Each local implementation has to take into account the contextual factors and constraints and make appropriate adaptations" (2003:107). not merely duplicate innovative experiences from other contexts.

## ***1.2 Previous Research***

Studies on implementation have been undertaken in several countries both by individual researchers, national organizations or government evaluation and monitoring institutions. The UK has used organizations such as the British Educational and Communications Technologies Agency (BECTA), the Office for standards in education (Ofsted) and the National Grid for learning (NGfL) to evaluate school and classroom implementation of ICTs in its schools. International organizations such as the United Nations Educational, Scientific and Cultural Organisation (UNESCO), the International Society for Technology in Education (ISTE) and the World Bank for Development (WorLD) have also contributed vastly to the study of computers in schools and have produced guides for educationists in this area. Their studies have investigated ICT implementation in many countries: both in developed and developing countries.

As I explored the literature on ICT implementation, I was able to identify several factors as essential in the process of planning for, obtaining, managing and using computers to improve the administrative procedures, as well as incorporating them into the curriculum. These factors can either enable or constrain effective implementation depending on the context of the school. The main focus in implementing ICTs in schools over the last 20 years has been equipping schools with computers with little consideration of the role of the technology in the schools (Flanagan & Jacobsen, 2003) Recently, in developed countries the focus has changed to integrating ICTs into school curricula: that is, using computers as tools with the goal of transforming schools like it has occurred in other spheres of life. This focus has been influenced by the minimal benefits identified when these technologies were used as a supplement to the curriculum or merely

facilitating the existing curriculum: the common uses of computers in developed countries for many years.

With this change of focus, the challenge for schools has changed from simple technological adoption to a process of innovation that requires both financial and training support for the main change agents in schools - principals and staff (Yeun, Law & Wong, 2003: 159). According to Yeun *et al.* (2003) the principal as leader in a school should be trained to take care of school-level implementation and teachers for classroom implementation. Ideally, teachers and principals should have been trained before the introduction of the technologies into schools. This was not possible because schools started exploring ICTs before there was a government ICT policy and coordination in Lesotho. Other places, such as Hong Kong, the United Kingdom and the USA also followed this trend in ICT introduction in schools. With this insight, the influence of my job as subject advisor, and being involved in in-service training of teachers, my focus settled on the role of principal leadership and teacher professional development for technological infusion. Additionally, resources were considered as the schools with which I was going to work already had ICT resources and I thought it would be useful to look at issues related to resources in schools so that I would be informed about technological issues.

From the literature, it is evident that ICT implementation is a process that occurs over a period of time and in stages, developing from incidental and isolated use of computers by one or more teachers to integrating ICTs into the curriculum (Van Melle *et al.*, 2001). Awareness of these stages and the identification of best practice can assist in teacher professional development and any other school interventions.

### **1.3 Context of the research**

In his study of Third World countries in the late '80s, Hawkrige and other researchers included Lesotho. The study indicates that in 1987 there were virtually no microcomputers in schools, no teachers trained to teach them and no Ministry of Education policy. One school had started a course in computer education but was forced to abandon it because of lack of staff and resource shortages. The situation in Lesotho schools has changed from the non-existence of computers in early '80s to 80 secondary schools with computers from a total of 240 secondary schools (M.

Nketekete, personal conversation, May, 2006). Nketekete conducted a survey to find out how many schools in the country had computers, and when they started using computers, and he stated that the first instance of computers in schools occurred in 1984 in Lesotho; contrary to Hawkrige's findings. This was in a Catholic boys' school where the principal, a priest from the USA obtained donations from his country. The computers were used to offer ICT literacy to bright learners in the school. The year 1984 is in agreement with the report given in the SchoolNet Newsletter (Kebede, 2006).

The introduction of computers in Lesotho secondary schools started sometime in the mid '80s, long before the government started initiatives to coordinate the efforts: hence these initial efforts of individual schools have been haphazard (Kebede, 2006:2). Government initiatives began sometime in 2002 with the formulation of an ICT policy (Kebede, 2006: 2). The policy was an all encompassing one, covering all government sectors, not specifically ICT in education. The final draft of the policy was completed in 2005. In a section of the document referring to educational institutions as one of the stakeholders in implementing the policy, the expectations are that educational institutions must:

- play a major role in improving teaching and learning mechanisms that develop a society that is ICT literate and capable of producing local ICT products and services:
- ensure that ICT literacy is part of the core curricula: and
- use ICTs to expand access to education as well as improving the quality of education (Lesotho, Govdoc, 2005:25).

The development of a Computer Education Curriculum by the Curriculum department of the Ministry of Education (MoE) also started around the same time with policy formulation and its first implementation in 14 trial schools was in 2003. One of the schools that participated in this study, School C, is one of the schools involved in the piloting of this Computer Education Curriculum at Junior Secondary school level. Another school that participated in my study, School B, uses the curriculum to enhance computer literacy skills of learners for the learners in the first and second years of junior secondary. The junior phase of secondary schooling is three years, at the end of which there is an external examination. This is followed by the senior secondary level which lasts for two years. The piloting started in the first year of secondary

schooling (Form A) and the first group of learners sat the external Computer Education Examination at the end of 2005 for the first time.

Three schools were involved in this study. Two of the case study schools (Schools B and C) introduced computers in 2002 while the government was still in the process of formulating an ICT policy. At the time, Schools B and C had a few computers which were used for administration purposes only. Consequently, their ICT planning and exploration started before the announcement of the government's ICT strategy. The third school, School A, is a NEPAD School and has had computers for approximately a year. The school obtained computers for administration, teachers and learners as a gift from the NEPAD Initiative through the MoE in Lesotho. So the implementation of computers in this school was a government initiative unlike the other two schools.

The ICT curricula used in Lesotho schools have also varied greatly since there was no MoE curriculum until in 2003. The majority of schools acquired computers from private companies who benefited vastly from renting computers to schools. The ICT curriculum used in these schools was designed by the private companies' personnel. Computer teachers were also provided by computer companies for the schools because there were no teachers in schools with sufficient computer know-how. Some schools used the Cambridge Overseas curriculum in the last two years of secondary schooling (M. Nketekete, private conversation, May, 2006).

This haphazard acquisition of computers and use of different ICT curricula by schools necessitated the government to develop a certain uniform mechanism to enable schools to benefit from the resources that ICTs can offer (SchoolNet, 2006:2). The ICT Policy is one such mechanism: and in the document section on 'Education and Human Resource Development' states that one of the Government of Lesotho (GoL)'s strategies to achieve its objectives is to:

- Encourage all educational institutions to invest in computers and to connect to the Internet:
- Develop ICT curricula for all levels of the education system:
- Work with the private sector to create affordable packages and schemes under which students, teachers and educational institutions can afford ICT products and services (Lesotho, Govdoc, 2005:29).

The second strategy has been undertaken in part by the development of the computer studies curriculum for the first three years of secondary schooling, and is currently being piloted in 14 trial schools in the country. As yet, there is no curriculum for the primary schools. However, private companies have designed computer literacy courses for secondary school learners and in-service training of the workforce. Learners can enter these courses at any stage in their secondary schooling, for example, when they drop out of school for some reason they register for computer literacy courses. Parents believe these courses can make them employable.

The development of the Computer Education Curriculum was another government strategy to coordinate the haphazard use of curricula in schools. The learning objectives of the MoE curriculum are stated in the 2005 curriculum document as follows:

After the completion of the course, students should:

- Have acquired basic knowledge about computers, that is how they operate and their role in the society:
- Have developed positive attitudes and appreciation towards the use of computers in everyday life:
- Be able to communicate ideas and information in a variety of forms using computers:
- Apply basic knowledge and skills acquired in solving everyday problems:
- Be aware of social, economic, ethical and moral issues raised by computers in a society:
- Have acquired basic knowledge and skills for further learning in Information and Communication Technology (ICT) area and its related field:
- Have acquired basic knowledge and skills in ICT that would enable them to secure employment related to ICT (Lesotho, MoE, 2005: 2).

The objectives stated in the curriculum can be grouped into three categories as: (a) Societal (b) Pedagogic and (C) Vocational, following the terminology coined by Hawkrige (1990). It therefore, means that through the curriculum, the government intends to prepare its learners to be computer literate citizens in the knowledge society: to equip them with knowledge, skills and attitudes for careers in information technology and related fields as well as to prepare learners for the world of work. This corresponds to three of the four Hawkrige's framework of rationales

discussing reasons for placing computers in schools in Third World countries (Hawkrige *et. al.*, 1990).

SchoolNet and NEPAD e-schools initiatives are other initiatives in the country that have been launched in the country as strategies to enable schools to benefit from the resources that ICTs can offer in a coordinated manner. These two initiatives intend to address the third ICT policy strategy. SchoolNet-Lesotho is a Non-governmental Organisation (NGO) that aims to support and promote the wider use of ICTs in Lesotho schools (Kebede, 2006:2). Its main goal is to “lay strategies for the effective application of ICTs and other appropriate technologies in education and promote sufficient collaboration and cooperation amongst students, teachers, and the public” (SchoolNet Constitution document, 2006).

SchoolNet Lesotho was formally launched in February 2003 with financial and technical support from Open Society Initiative of Southern Africa (OSISA) (Thabana, 2006). SchoolNet’s main activities are to purchase computers and install Local Area Networks. The initiative commenced its activities by conducting pilot projects in five schools and in 2006, 16 secondary schools were members of SchoolNet Lesotho (Kebede, 2006:4). One school in the Mafeteng district is a member of the SchoolNet initiative. At the time of the research the school had only been working with SchoolNet for a few months. It had just received 10 computers for learners and peripherals from SchoolNet, but the network had not yet been installed. Although I wanted to include a SchoolNet school as one of the case study schools in the district, this was not possible due to minimal experience of the use of computers with learners.

The NEPAD e-schools Initiative was launched formally in 2005 in Lesotho. The initiative’s goal is to prepare the African youth for “active and equal participation in the information society and the knowledge economy” (African Union, 2004:8). The implementation process of the project involves:

- The installation of ICT equipment in the schools along with the associated software:
- The training of pre-service and in-service teachers to use this technology to impart ICT skills to the students as well as facilitate preparation and delivery of course materials in all other subjects:

- The use of ICT to develop appropriate course materials and make them available to schools and teachers:
- The establishment of an Africa-wide satellite network that will connect schools to the internet as well as to the points within each country from which educational content will be led to the schools on a continuous basis (African Union, 2004:8).

Presently, the project is at the pilot stage in Lesotho and other 15 African countries. The first three steps of implementation have been partly realized in the six schools. The pilot phase involves six schools in each country. The ICT equipment has been installed in schools and four teachers have been trained in each of the schools. The trained teachers are supposed to offer training to the remaining teachers at the schools. They have been provided with training material for in-house training of other teachers. There is also provision of subject-related software for several subjects in the school curriculum for use by teachers with learners. Pre-service training is supposed to be provided through the African Virtual University, which already had 39 learning centres in 21 countries in 2004. The centres would be expanded to other African countries in the next two years: but as yet, there is no training centre for teachers in Lesotho. However, the project claims to rolling-out to the rest of the schools in five years' time (African Union, 2004:9). The expectation is that by the 2010 the rest of the secondary schools in Lesotho will be provided with ICT equipment similar to the one provided in the six pilot schools: however, this remains to be seen.

School A is a NEPAD project school in Mafeteng district and it has benefited immensely from the project. It has been provided with computers for learners, teachers and administrative staff. All of these computers are networked and there is also satellite internet connection at the school. This is the only school in the Mafeteng district with Internet connection.

## **1.4 Research Goals**

While the implementation studies indicate potentials of ICTs in transforming schools in other countries, this research will be helpful to ascertain whether this is possible in the Lesotho context given the available infrastructure and other necessary factors for implementation. The research could thus provide possible strategies for implementation at government level, school level or classroom level to realize ICT policy and curriculum goals as stated in the ICT policy and curriculum documents.

The goals of the research are to:

- Understand the prevailing enablers and constraints of ICT implementation in each of the case study schools
- Use the case studies to suggest ways in which schools could learn from each other's ICT implementation as well as inform the intended countrywide roll-out of the NEPAD project.
- Inform the MoE in order for them to develop suitable in-service training for teachers on the basis of the identified constraints and enablers of ICT from the case studies.

## **1.5 Research Questions**

The main research question was: What are the key enablers and constraints for the successful implementation of ICTs in Lesotho schools? This question was broken down into the following subsidiary questions:

- What role does principal leadership play in enabling or constraining the implementation of ICTs in secondary schools?
- What role does teacher professional development play in enabling or constraining the implementation of ICTs in secondary schools?
- What role does resource provision play in enabling or constraining the implementation of ICTs in secondary schools?

## **1.6 Research Method**

The purpose of this research is to find out from key people what they view as enablers and constraints for the successful implementation of ICT in their schools. The researcher questioned key people in the school about experiences of planning for, acquiring and using ICTs, what they view as enabling and constraining factors. This makes an interpretive orientation suitable for this study as this orientation seeks to understand the subjective world of human experience (Cohen, Manion & Morrison, 2000).

The case study schools were selected primarily on their reported practice of having used computers for longer than the rest of the schools in the Mafeteng district where I work as a subject advisor. Another criterion used for selection was that the schools had to have computers for all users in the school, that is, administration, teachers and learners. With their more extensive experience in the use of ICTs those schools could offer rich, in-depth data of their ICT implementation process.

The selection of appropriate cases was seen as a key process and one which required careful consideration and background research. Relevant government officers that were involved in computers in education were consulted. I identified two officers in the MoE for consultation, the officer in charge of the Computer Education curriculum in the National Curriculum Development Centre (NCDC) and the Country Liaison Person of the NEPAD Initiative. The two officers supplied information on which schools would be more suitable for my study. My intention as a teacher advisor is to work with at least one school in each of the initiatives mentioned above, that is, one school from the NEPAD Initiative, one school from SchoolNet and one school supported by the NCDC department of the MoE. This should serve to provide a broad spectrum of the schools to learn from. Coincidentally, the geographic locations of the schools are varied: one school is located in town, another school is in a semi-urban area and the last school is in a rural area.

Participants in the study were the three principals from the three selected schools and a staff member responsible for Computer Education at the school: the Computer Teacher (CT). Three other staff members were identified by principals as teachers who have been seen using computers more frequently than others. Another criterion used for the selection of a subject

teacher was that the teacher should have been seen using computers with learners so that he/she would be able to contribute to questions on how the computers were used in subject teaching and/or learning. The maximum expected number of participants was 5 at each school, but the actual numbers were 5 in School A, 4 in School B and 7 in School C making the total of 16 participants. The numbers turned out as expected only in School A: one principal, one Computer Teacher and three Teachers. In School B, there were two Computer Teachers, but one of these teachers was not present on the day of collecting the data and one of the three selected subject teachers did not hand-in his filled-in questionnaire. In School C, the number increased to seven because there were three Computer Teachers, three subject teachers and a principal.

Documents on ICT implementation strategies at the schools were also collected during visits. Arksey and Knight claim that “when used with other research methods documents can be invaluable as sources of background knowledge and for cross-checking the data” (1999:17). The documents collected from the schools were the Computer Education Curriculum and a teachers’ guide from the NEPAD School.

Taking field notes involved me actually observing and recording what I saw at the school which also served to cross-check data obtained from the questionnaires, interviews and documents. Documents and field notes however do not form the primary sources of data but assisted in the interpretation of the data. The following table (Table 1.1) summarises the organization of the data collection process.

**Table 1. 1: Data Collection Schedule**

QUESTION FOCUS	Collection method & participants			
	Questionnaire	Interview	Documents	Field Notes
1.Principal Leadership	CT, T	P	P, CT, T	R
3. T. Professional Development	CT, T	P	P, CT, T	R
2.Resources	CT, T	P	P,CT, T	R

**Key:**

- P = Principal
- CT = Computer Teacher
- T = Teacher
- R = Researcher

## **1.7 Overview of the chapters**

This document is structured in such a way that the first chapter has introduced briefly the concept of ICT and what component of ICT the study will focus on. The section on the context of the research has tried to describe briefly the situation in Lesotho in relation to ICT in schools. The method of research to be embarked upon was also outlined. The chapter ends with an overview of the chapters to follow.

**Chapter 2** endeavours in the first instance try to establish why and how schools in both developed and developing countries introduced computers into their education systems: theories underlying the use of computers in schools are then considered as one other reason to justify their introduction into classrooms as relevant literature shows that certain learning theories have influenced how computers were being used in schools.

**Chapter 3** provides a second section of the literature review by focusing on how principal leadership, teacher professional development and resources either enable or constrain the use of computers in schools: therefore, literature is reviewed in these areas as well. These issues are discussed within the context of a few developed and developing countries.

**Chapter 4** commences with a description of the research environment and then provides a detailed description of how the research was conducted. The research environment entails the description of the three case study schools and the participants at each school. This chapter covers how the case study schools and participants were selected, the designing of the data collection instruments, piloting the data instruments and the actual data collection at the schools. The chapter ends with how the analysis of the data was undertaken.

**Chapter 5** presents the data as categorized during the data analysis process. The main categories identified were: Infrastructure, experience and training, Internet Connectivity, Computer use, Subject integration into the curriculum and Planning and Support. The presented data is then interpreted and discussed in the light of what seemed to be the emerging constraining and enabling factors. At the same time, reference is made to issues that emerged in Chapter 2 so that a relationship is made to the existing literature on the issues. The case study issues are discussed both individually and alongside each other.

**Chapter 6** concludes the research by providing a summary of the findings and relating the findings to the goals and research objectives. It also provides recommendations directed at government and school leadership. As a way of reflection on the study, limitations of the study, suggestions for further research and lessons learned are provided at the end of the report.

## **Chapter 2: Why Information Communication Technologies in schools?**

### **2.1 Introduction**

The literature review in this research paper will be presented in two parts to address the main foci of the study. First, the reasons for incorporating ICTs into school systems (this chapter) and then the key issues in the ICT implementation process (chapter3) will be discussed. The rationales behind implementing computers in schools will be argued to establish why decision-makers were motivated to acquire computers for schools in the first instance and how they dealt with implementation issues they faced thereafter.

Key implementation issues were identified by examining the implementation 'processes' found in various research studies, both in developed and developing countries. At the same time, the prominent enabling and constraining factors were identified, as well as the role of the main stakeholders in schools with regard to ICT implementation. The review uses the research questions as a framework: an examination of ICT implementation strategies; the enabling and constraining factors in ICT implementation; and the roles of the main ICT implementers in secondary schools.

### **2.2 The rationale behind ICT implementation in education**

Rapid developments in information and communication technologies (ICT) in recent years have resulted in significant changes in the way the world operates and communicates. The use of computers is evident in every sphere of life: supermarkets, banking machines, government offices and medicine. "This surge in technology use has led to demands that education achieve and maintain currency in ICT implementation, both to respond to and shape broader societal developments" (Granger *et al.*, 2002:480). Early implementation in schools has focused on supplementing the existing school curriculum and has used computers as delivery devices (Pelgrum, 2003; Roblyer & Edwards, 2000; Morrison *et al.*, 1999). More recently there has been increasing pressure on decision-makers to acquire new technologies to satisfy

this educational need and other societal needs despite a history of achieving only marginal benefits from using ICTs in education (Hokanson & Hooper, 2000; Bottino, 2004; Flanagan & Jacobsen, 2003; Schiller, 2003).

After experimenting with computers in schools for over 20 years in developed countries with limited benefits educators, parents, politicians and technologists are now ready for a new approach to using computers (Morrison *et al.*, 1999:14). Research has provided evidence that "achieving outcomes with ICT requires more than simply providing access to hardware and software. Rather a complex myriad of variables is involved in enhancing teaching and learning with ICT" (Cuban & Venezky cited in Van Melle *et al.*, 2003: 267). Recent studies on classroom implementation have indicated improvement in the teaching and learning process when ICTs are integrated into the curriculum (Alexander cited in Baggot *et al.*, 2004; Kozma *et al.*, 2004; Tearle, 2004). Integration into the curriculum has been defined as the use of computers as 'representational' at one level and as 'generative tools' at another level (Hokanson & Hooper, 2000). The representational use of computers refers to their use as a medium to represent information: whereas the generative use refers to generating or constructing new information.

Hawkrigde, Jaworski and McMahon's (1990) categories will be used as a basis for discussion because in studying the literature on this topic it appears that most reasons for computers in schools fit in one or more of their categories. Hawkrigde *et al.* (1990:17) identify and describe four main reasons for the use of computers in schools and have named them "rationales". These are the: social: vocational: pedagogical and catalytic rationales.

### **2.2.1 The social rationale**

The social rationale recognizes the increasing importance of ICT in our everyday social, political, and cultural life. ICT applications such as e-mail, access to on-line information, e-commerce and e-banking are being used to improve the quality of everyday life. ICT awareness has therefore become an essential life skill and it includes not only familiarity with ICT tools, processes and services, but also an understanding of ICT-related public issues that allow informed judgments to be made (Markauskaite, 2006).

The social rationale suggests that all learners should be aware of and not afraid of how computers work. Because computers play an increasingly important part in modern life and because schools are supposed to prepare children for adult life, it follows that schools should provide some measure of computer awareness and literacy.

Similar to Hawkrige *et al.*'s Social Rationale is Wright's 'technology for its own sake' rationale (2000:19). He contends that "some nations may decide to invest in technology for education for the 'glitz factor': The technology is there: it is fashionable to have the latest and the best, and it gives a sense of progress to use state-of-the-art technology" (Wright, 2000:19). Wright's statement implies that some governments may place computers into schools without fully understanding the educational benefits or drawbacks or changes that may ensue. Postman (cited in Hokanson and Hooper, 2000) however, illustrates how changes in media abilities can affect the society profoundly:

New technologies alter the structure of our interests: the things we think about. They alter the character of our symbols: the things we think with. And they alter the nature of community: the arena in which thoughts develop (2000:540).

Hence a new kind of literacy needs to develop with the emergence of new technologies. Although Wright suggests that one of the reasons of placing computers into schools is due to schools succumbing to what is fashionable at the moment, Postman gives a thoughtful explanation for this practice. He proposes that these new technologies have pervaded every sphere of life so rapidly that it is virtually unavoidable not to think about them and use them in communities and even consider including them in the school curriculum (Postman cited in Hokanson & Hooper, 2000:540).

An implicit, if not explicit social rationale led to the development of the common computer awareness and literacy courses in schools. However, there are some opposing views against this reasoning in the literature. Jonassen states that: "... students generally do not need to study a tool – especially one as powerful as a computer – in order to understand how to use it" (1996:8). Hammond made a similar statement in his paper:

This does not imply that the acquisition of computer skills should be a goal: these skills are relatively easy to learn. Our students ought to have these computing tools simply because the tasks of learning can be facilitated as colleges are clearly finding (1995:5).

Jonassen reiterates that: "Tools are really useful only if they help you perform a task you need or want to perform" (1996:8). Similarly, Postman (cited in Van Melle *et al.*, 2003: 273) warns that since technology is becoming so much a part of our everyday lives, it is easy to use the technology for the sake of using it, with a danger of the environment being shaped by the technology and student learning becoming a secondary consideration, as Wright (2000) stated earlier.

It is useful for policy-makers to consider both the supporting and opposing arguments for computer literacy in schools so that informed decisions can be made. Computers are very expensive and schools cannot spend vast amounts of money on them for awareness only.

## **2.2.2 The vocational rationale**

The vocational rationale suggests that children should learn to operate computers because learning to program gives learners confidence in their ability to control computers (Hawkridge *et al.*, 1990). Learning how to use application programs such as word processors, spreadsheets, databases etc. provides marketable skills that will be needed later in life. These programs are sometimes referred to as productivity tools because they are used widely in business and commerce. According to this rationale, computer literacy and computer science should be offered in schools as options for learners to choose from. This rationale involves training learners for all areas of the workforce: computer literacy to train professionals with a high level of ICT competence for the non-ICT areas of the economy that rely heavily on ICT and computer science to train specialists for the ICT industry (Markauskaite, 2006:15).

Computer literacy is defined as a non-professional computer education course with the intention to teach *about* computers: the operation, applications, ethics, use and misuse of computers (Alessi & Trollip, 1983:51). The term, computer literacy was invented by educational computing pioneer Arthur Leuhrmann in 1980 and he defined it "as programming

skills and use of tools such as word processing" (Roblyer and Edwards. 2000:10). The most recent definition of computer literacy is that of Markauskaite. "the capacity to apply ICT in various areas of human life" (2006:15). The latter, a much broader definition, seems to address the recent focus of using computers as tools in different areas of the curriculum.

The vocational rationale is similar to what Wright (2000:19) terms 'developing skills for the labour market rationale.' Which labour market is being referred to here? This is the labour market of the future when present learners will have finished schooling, some 12 or more years later. Will this present technology still be the same? It will probably not be the same because "every 12-18 months the power of computer technology doubles, so that the technology of today might not necessarily be the technology of tomorrow" (Erhmann cited in Van Melle *et al.*, 2000:274). So again, is preparation for the future labour market as a goal for introducing computers into schools still worthwhile when technology will be so different? Hammond's response is:

It is wrong to assume that computers must be in schools, or kids won't be able to get jobs in an increasingly computerized world: learning to use a computer takes no more than a month or so (1999:5).

Again, Wright sees this vocational reasoning as external to education because it is concerned with developing skills for the *labour market*. Roblyer and Edwards (2000) however, raise awareness of the origin of the vocational reasoning. They state that this view originated with industry trainers and vocational educators in the 1980s, and was termed *technology training*. This perspective was based on the arguments that one function of schooling is to prepare learners for the world of work and "that vocational training can be a practical means of teaching all content areas such as math, science,... robotics, manufacturing systems and computer-assisted design (CAD) systems" (Roblyer & Edwards, 2000:7).

Computer literacy is very common in Lesotho schools and it is taught in computer labs which formerly housed typewriters, were science labs or in newly erected buildings. Learners in Lesotho who take these courses can possibly obtain clerical jobs in government and other offices if they do not intend to further their studies in technical schools or universities. Computer science is not a very common option in secondary schools in Lesotho because it

demands appropriately qualified teachers in the field and presently, computer science teachers are a rarity in schools. However, computer literacy can be viewed as a foundation course to prepare learners to further their studies in computer science or information technology at colleges or universities as well as making them employable. In fact, the Lesotho Computer Education curriculum document alludes to these possibilities (MoE, 2005:1). Two out of the seven aims of the curriculum suggest that after completion of the curriculum learners will:

- Have acquired basic knowledge and skills for further learning in Information and Communications Technology (ICT) area and its related field
- Have acquired skills in ICT that would enable them to secure employment related to ICT (MoE, 2005:1).

Some ICT in education research studies have indicated a move from teaching learners *about* computers to teaching learners *with* or *through* the computers (Jonassen, 1994; Cloke & Sharif, 2001). This means that learning how a computer operates and its applications is becoming an unnecessary activity because technology is evolving dramatically and quickly (Roblyer & Edwards, 2000:11; Anderson, 2002: 38; Howie *et al.*, 2005:9). Teaching *with* the computer refers to the use of a computer to reinforce or enrich the curriculum and teaching *through* the computer refers to using computers as tools to facilitate an emerging curriculum (Scrimshaw, 2004:5). The next sections will explore the idea of using computers to enrich the curriculum: that is using computers as tutors (Taylor, 1980).

### **2.2.3 The pedagogic rationale**

The pedagogic rationale is based on “a strong belief that *computers can teach*” (Hawkrige 1990:2, italics in the original). For more than two decades the computer has been used to tutor students through a variety of programs known as Computer-Assisted Instruction (CAI) or Integrated Learning Systems (ILS) (Shelly *et al.*, 2002:5,21). These programs were seen to offer certain advantages over traditional methods of teaching and learning: “They offer individualized instruction and exploration: allowing students to examine their skills in a risk-free environment: and providing instant feedback, testing, and review” (Shelly *et al.*, 2002:5,21). These programs typically present tasks for which there is only one correct answer. CAI is also most useful in supporting scaffolding or remediation needed to solve a problem

(Morrison *et al.*, 1999:16). The teacher needs to carefully select applications that support his/her objective (*Ibid.*:16). In ILS, computers are networked and equipped with software that provides a set of sequential lessons. These programs are integrated because each lesson is connected with the next. There are tests at the end of the lessons which are correlated to the lesson objectives. The programs are equipped with a built-in management system that tracks individual student progress (Shelly *et al.*, 2002:5.24). In a fairly limited didactic sense, the computer 'becomes' the teacher or the tutor.

Taylor proposed a "tutor-tutee-tool" model to help those who initially wanted to understand the concept of computers in education. According to him the computer could be used "as a 'tutor' that effectively 'teaches' the learner via pre-programmed material ..." (Taylor, 1980:5). Here, tutoring systems present subject material, to which the learner responds. This type of material is programmed by specialists and includes drill-and-practice exercises and tutorials. The programs vary widely, from the simply repetitive to sophisticated tutorials which check on progress and suggest areas for remediation.

At one level this rationale makes the computer no different from technologies that have come and gone before it: namely, the slide rule, the abacus, the logarithm etc. The opinion above is reiterated by Jonassen thus: "Technologies as conveyors of information have been used for centuries to 'teach' students by presenting information to them which they are obliged to 'learn' (1996:1) This type of instruction has been around for sometime and is informed by the behaviorist theory (Morrison *et al.*, 1999:5).

There is more criticism of this approach of using computers as tutors that deliver instruction. Salomon, Perkins and Globerson (1991) and Taylor (1980) have raised these criticisms:

- "No computer technology in and of itself can be made to affect thinking. One needs to consider, both theoretically and practically, the whole social and cultural milieu in which instruction takes place" (Salomon *et al.*, 1991:3).
- And for the computer to function as a perfect tutor in some subject it "must be programmed by 'experts' in programming and in that subject" (Taylor, 1980:3).

The criticisms stated above allude to the notion that instruction is a complex process shaped by teaching and learning theories, school and subject cultures, teacher experiences and so on; and all these factors affect learners' thinking and learning.

As far back as the early 1980's there already existed good software material using this mode of teaching by some pioneers of Computer Assisted Instruction (CAI) such as Suppes and Bork (Taylor, 1980); and for those interested in the tutoring mode of computer use these can provide a good guide for teachers, who may be trained in programming to produce their own subject-related material. What is critically important is that technologists should not undermine the importance of a teacher as the main mediator in learning. Learners can be instructed by the computer for a while, but the computer is a machine and it will not be able to detect when the learner needs various forms of guidance. "Youngsters need a quality of guidance ... the only dependable place to which students can turn for such guidance is a teacher" (Oppenheimer, 2003:297). Bialobrzeska and Cohen also argue for the importance of a teacher as guide:

... the central importance of the teacher as mediator may once again not be sidestepped. It is generally not wise to allow learners to use any software without the teacher's facilitation, since the software simply diagnoses a problem instance. It remains up to the teacher, to provide the remedial support, to overcome the problem (2005:28).

There are however, certain benefits of using these programs, as proponents of this way of learning, Bork, Papert and Suppes, view this kind of learning as 'interactive' (Taylor, 1980). Their notion is that it requires user input and program response: hence there is communication between the user and the program. Other advantages are that "it allows learners to practice at their own pace, and to choose and work at their own level. It can offer a convenient way of giving support to learners who need additional practice" (Bialobrzeska & Cohen, 2005:28).

In summary, one realizes that there are certain benefits of using the computer as a tutor as highlighted in the previous paragraph. However, there are concerns that the tutoring programs are produced by technologists who might be experts in programming but not necessarily experts in the subjects being taught (Taylor, 1985). Other concerns raised are that the software designers tend to overlook the role of the teacher as a guide and mediator in the learning

process and the programs may overlook the cultural and social backgrounds of the learners (Taylor, 1985).

#### **2.2.4 The catalytic rationale**

The belief here is that computers are able to change education for the better: that is, computers are a stimulus to a change in education (Hawkridge *et al.*, 1990). Managerial, administrative and teaching efficiency can be improved. "It seems the current belief is that ICT is not only the backbone of the Information Society, but also an important catalyst and tool for inducing educational reforms that change our students into productive knowledge workers" (Pelgrum, 2001:163). Some of the contemporary ideas around the subject of 'the catalytic potential of ICTs to transform education' are that the use of computers enable teachers to place more emphasis on important problem-solving approaches rather than on tedious rote learning and calculation. Secondly, it is possible for computers to provide children and teachers with independence as they research topics of interest or pursue their own projects. Thirdly, collaborative learning, rather than competitive learning, can be stressed while learners share the use of computers and the information they find. (Morrison *et al.*, 1999).

The ideas raised above match the currently preferred learning strategies: that is, problem-based learning, collaborative learning, independent learning, inquiry, and so on. Currently, these are some of the highly desired teaching and learning strategies and are generally termed active learning. "Active learning presupposes that the learner has easy access to information sources" (Pelgrum, 2001:165). And, nowadays the Internet and interactive databases on CDROMS provide vast information sources (*Ibid.*:165) and hence the computer can become an appropriate tool to foster active learning.

Some literature alludes to computers having an impact on the school curriculum as a whole which can foster what is termed the 'emerging school curriculum' (Scrimshaw, 2004). An emerging curriculum is characterized by a student-centred form of teaching and learning where learners sometimes work independently to solve everyday problems using computers (Scrimshaw, 2004:13).

Another way of viewing at the transformational impact of computers is to look at the educational practice because "educational outcomes are related to educational practice" (Twining, 2002:95).

Wright (2000) also argues for change in educational practice by viewing improved practice in terms of processes such as thought processes, information flows and human communications. If technology can improve these processes then it can enhance the education process: and it follows that the changes in technology can be analyzed in terms of their impact on the aforementioned processes. To illustrate the transformational capability of ICTs, Lawson and Comber (2002) have suggested that ICTs tend to transform the way in which learning and teaching occurs, as well as other aspects in a school system such as communication between teachers and learners.

There is no reference to the catalytic rationale in the Lesotho Computer Education curriculum document, but in the ICT policy document there is mention of educational institutions being required to include ICT literacy in the core curriculum (GoL, 2005). The next section elaborates upon how the learning theories influence the use of the technologies in teaching and learning.

### **2.3 Learning Theories underpinning ICTs for teaching and learning**

There are basically three major learning theories underlying the use of computers in teaching and learning: behaviorism, cognitivism and constructivism. As the main beneficiary in the teaching and learning process should be the learner, all teachers hopefully aspire to learning to have taken place after the process of teaching. So what is learning? Duffy and Cunningham define learning as “a process of information acquisition, processing according to innate or acquired rules, and storage for future use” (cited in Jonassen 1996:176). This is similar to Wright’s idea of improved educational practice as being viewed in terms of improved thought processes, information flow and human communication. Hokanson and Hooper are also in agreement with these three authors as they hold that: “If the purpose of education is to build cognitive strengths, computer use must demand that learners invest mental thought *to develop these cognitive strengths*” (2000:547).

#### **2.3.1 Behaviourism**

Behaviorism has been around since the beginning of the 20<sup>th</sup> century and it has had a major influence in the learning field and it is continuing to play an important part in it. According to behaviorists, such as Skinner, learning is a form of behaviour change and has nothing to do with the internal cognitive processing of information (Shelly *et al.*, 2002:6.55). The behaviour

modification procedures developed by behaviorists have proven useful to many teachers: teachers have implemented these theories for some time (Shelly *et al.*, 2002:6.55).

The behaviorist approach is characterized by the teacher selecting content and developing lesson plans to cover the content in a sequential manner. The teacher has preconceived objectives and learning outcomes and he/she strives towards mastery of the small bits of knowledge and skills. The teaching process is essentially a behaviour modification procedure at the end of which success or failure can be assessed. The learners, on the other hand, have merely to receive all the necessary information from the teacher and the textbook and then regurgitate the bits of knowledge as intended by the teacher during assessment, which is performed by through various means of measurement of knowledge and skills. Basically, within this approach, the teacher determines what is to be taught while the learner is a passive recipient of what is being taught: hence this approach is sometimes termed the teacher-centered approach. Teacher-centered pedagogy has dominated classrooms from the beginning of the 20<sup>th</sup> century: and anecdotal evidence shows that majority of teachers are still being guided by this theoretical understanding of education by the way they teach and use media, including computers (Hokanson & Hooper, 2000:543).

Critics of behaviourism such as Hammond (1995) say the approach oversimplifies human behavior and sees the learner as an automaton instead of a creature of will and purpose. Hammond (1995) criticizes this approach because it assumes that behavior is predictable. Kennewell criticizes the approach by asserting that it portrays a very limited role for the teacher (2004: 89).

Behaviourism has been used to explain the set of procedures characteristic of many existing Computer Assisted Instruction (CAI) packages. Although there is criticism of the behaviorist approach used in CAI and drill-and-practice software, I think the effectiveness of CAI software depends largely on how well the program has been designed so that it encourages sufficient rote memorization of the content which may later encourage the development of higher order thinking as desired by cognitive theorists.

Skinner, the major behaviourist proponent, focused only on external, directly observable indicators of human learning. Many people found Skinner's explanation insufficient to guide instruction: hence cognitive theorists during the 1950s and 1960s devised another model: "they

hypothesized processes inside the brain that allow human beings to learn and remember” (Roblyer & Edwards, 2000:55).

### **2.3.2 Cognitive Theory**

Cognitive theorists focused on internal processes that went on during learning: they hypothesized that there were processes inside the brain that allowed human beings to learn and remember (Roblyer & Edwards, 2000: 53). It is this consideration of the mind as being actively involved in learning by cognitive theorists and the mind as an inactive separate entity by behaviorists that created a significant difference between behaviorism and the cognitive theory:

The view of mental activities as actions ... as opposed to their being considered indications of the presence of a consciousness or mind as a separate entity, are central differences between the behavioral and cognitive orientations (Burton, Moore & Magliaro in Jonassen, 1996:46).

Cognitive theorists postulate that an individual actively constructs meaning in his/her mind to try and make sense of the world (Duffy & Cunningham in Jonassen, 1996: 174). According to these theorists the brain contains structures that process information like a computer (Roblyer & Edwards, 2000:55). The theorists proposed a model of the mind whereby the brain acts as a storage structure with three kinds of memory, the sensory registers, the short term memory (STM) and the long term memory (LTM).

Information processing is believed to occur in the LTM where it is linked in some way to prior knowledge already in the LTM. For information to be processed and stored in the LTM the receiver must have been paying attention to it, otherwise it stays in the STM temporarily and then lost (*Ibid.*:55). The receiver can only pay attention if the senses are aroused in some way: this is called sensory curiosity by Alessi and Trollip (1985:225). For example, changing colors, scenes or sounds, as it is common with computer games or drill and practice software, are some of the ways that can stimulate sensory curiosity. The role of the teacher is to make sure that the information presented to learners is presented in an interesting way so that learners pay attention and store it. Cognitive theory is characterized by learners receiving and processing information to transfer it into long term memory for storage.

The reference to computers as 'cognitive tools' (Jonassen, 1994); 'thinking tools' (Pea, 1985) or 'cognitive technologies': Salomon, Perkins and Globerson's (1991) 'technologies of the mind' is based on the cognitive theory. Computers are believed to stimulate the mind to enhance information processing and storage much more efficiently by the learners. Pea argued that "Computers are commonly believed to change how effectively we do traditional tasks, amplifying or extending our capabilities ..." (1985: 168).

While the emphasis of the cognitive theories has been the "internal aspects of the learners: on their attitudes, behaviours and cognitive processes that are involved in learning interactions with the computer" (Brown *et al.* in Bottino, 2004:556), the constructivist theory to be discussed in the next section emphasizes the social nature of cognition and meaning (Resnick in Bottino, 2004: 557).

### **2.3.3 Constructivist Theory**

The cognitive theory was a precursor to the constructivist theory and as such it has influenced constructivism. Pea, in his seminal article in 1985 elaborated upon how different software is capable of not just amplifying the human mental power, but can also reorganize mental functioning. According to him amplification is characterized by the action being more efficient and faster through the use of the technology; whereas reorganization is characterized by the learner being involved in mental processes that bring about quality problem-solving and which would be impossible to do without the computer program. Pea summarizes the reorganization of the mind thus:

The closing of the gap between thought and action, between hypothesis and experiment, that these technologies enable and the rapid cycles of propose-test-revise that they thereby allow (much like the bases of spreadsheets and mathematics software) appear to have deep qualitative effects on how problem solving occurs, which are not anticipated or captured by the amplifier metaphor (1985:174).

The above quotation brings two ideas to the fore: the active processing and manipulation of information by the learner and the identification of this process as problem-solving. These ideas relate to how constructivism has been described in literature. Gardner has stated three

basic premises of a constructivist learning environment. They conclude that understanding is a result of:

- the learner reshaping and transforming information
- students striving to reduce discrepancies between what they know and what they observe
- one's knowledge being refined through negotiations with others and evaluation of individual understandings. This is evident in collaborative groups that allow a student to learn the views of others in order to challenge and test the viability of his or her own views (Gardner cited in Morrison *et al.*, 1999:6).

In constructivist theory, emphasis is placed on the learner rather than the teacher. It is the learner who interacts with objects and events and thereby gains an understanding of the features held by such objects or events. The learner, therefore, constructs his/her own conceptualizations and solutions to problems. Learner autonomy and initiative is accepted and encouraged. In the use of ICTs, the learner interacts with the computer program he/she is using in order to construct knowledge.

Constructivists view learning to be the result of mental construction, similar to cognitive theorists, but they go further and explain how this is fostered by the learner's and other learners' experiences. Students learn by fitting new information together with what they already know. People learn best when they actively construct their own understanding. Salomon, Perkins and Globerson explain how there is a mind-machine collaboration during the use of the 'intelligent technologies' (1991:4). At first the authors distinguish between effects *with* a technology and effects *of* a technology. Effects *with* a technology mean that people enlarge their performance with machines and this is similar to Pea's amplification of cognition (1985:167). And effects *of* a technology mean that a learner acquires cognitive skills or strategy during partnership with the machine and these remain with the learner long after the learner has used the technology. Hokanson and Hooper refer to the cognitive capabilities that stay with the learner after using a technology as the residual effects (2000:547) of the computer.

In constructivist thinking, learning is also affected by the context and the beliefs and attitudes of the learner. Learners are encouraged to advance their own solutions and to try out their ideas and hypotheses. They are given the opportunity to build upon prior knowledge. Unlike in

the behaviourist approach. Constructivism encourages learners to demonstrate different behaviour because their constructions will be different and there is no way that each learner's behaviour is going to be predictable. If the use of the constructivist approach can result in learners coming up with several ways of solving a mathematical problem, for instance, this could demand a great deal of preparation on the part of the teacher. The teacher has to be conversant with a range of the ways of solving the problem and maybe this is the reason why anecdotal evidence shows that it is not a very popular approach with teachers.

In my opinion, the three learning theories are complementary to each other. The behaviourist is concerned with how instruction is carried out systematically so that there is effective teaching and learning, while the other two theories try to understand how learning occurs in the minds of the learners and in relation to others. The main criticism of constructivists by behaviorists is that the process of learning is not systematic. Constructivists claim that there is nothing systematic about the way that we construct knowledge: every learner has different social experiences resulting in multiple realities (Vygotsky in Kanuka & Anderson, 1999:3).

Learner-centred approaches based on the constructivist theory have been recommended and encouraged in teacher workshops in Lesotho to no avail because the environment in which the approach is to be used is not conducive for the teaching approach. Most secondary schools in the country are characterized by large classes (45-60) and proper learner-centred teaching where teachers have to familiarize themselves with the social and cultural backgrounds of each learner and then tailor-make the instruction appropriately does not seem to be feasible. Anecdotal evidence shows that this more individually responsive instruction is not easy to implement and teachers tend to resort to what I coin a 'superficial' type of learner-centred teaching.

According to Hammond there are three significant concerns about using the constructivist technique with computers:

- It imposes an additional burden on the teachers at a time when they may not have moved sufficiently up the learning curve;
- supporting software may not be available; and
- assessment tools may not be in place (1995:10).

In the discussion so far I have tried to establish the underlying reasons why governments and schools have felt compelled to introduce computers in schools generally. The discussion on learning theories has endeavored to explain the educator's perspective with respect to ICT implementation in the classrooms. Implementation can be thought of as occurring at three levels: country level, school level and classroom level. The rationales discussed above relate mainly to country level implementation, and as such should assist governments in formulating policy to guide practice at school level. The next section describes a relationship between the rationales and the implementation strategies. A more detailed examination of implementation strategies in a few developed and developing countries in a later section will hopefully provide insight into why and how the ICT implementation efforts in these countries have progressed.

## ***2.4 Linking the Rationales to Implementation Strategy***

It is only logical for governments to introduce computers in schools when they are clear of the reasoning for doing so. Hawkrige *et al.* have provided suggestions for how country level implementation can be carried out depending on the rationales motivating the implementation (1990:23).

For a social rationale which is realized in schools by the teaching of computer awareness he suggests low cost micro-computers; large numbers of schools to be involved; and several teachers who can teach all students only in the second year of secondary schooling. He also provides an explanation to support his suggestions:

Under the social rationale, teachers are trying to demystify computers by establishing in the minds of as many as possible a general (but very basic) awareness of how computers work and how they are used in society (1990:42).

Because the purpose of the social rationale is just to demystify computers in the minds of the learners there is no need to buy expensive equipment and have intensive training of teachers. Most of the teaching can be done through visiting places where computers are used intensively, such as business places, government ministries and other private offices. In

addition software that simulates how computers work in the real world can be used to teach the learners (Hawkrigde *et al.*, 1990:39).

For pursuing the vocational rationale, Hawkrigde *et al.* suggest the purchase of medium-priced computers and better trained teachers (1990:40). Since the equipment will be much more expensive, schools can only be provided with a few computers for selected classes of students. Hardware and software provision can, therefore, be limited to a minority of secondary schools only (*Ibid.*:40). The learners can either study computer literacy only or both computer literacy and computer science. The two courses will be examinable at the end of secondary schooling. The output will then be learners with computer literacy certificates or computer science as related to the labour market. The courses should also offer the learners a possibility of furthering their studies at tertiary institutions in computer science. The result of this kind of strategy will be a smaller number of school graduates with computer science for the few computer-related careers (1990:23).

For the pedagogic and catalytic rationales, far larger bills for hardware, software and training can be envisaged. One of the factors that inflate the cost of the equipment to achieve these rationales is the high expense that goes into "developing and marketing suitable educational software ... Indeed, it is so high that few countries have attempted it" (Hawkrigde *et al.*, 1990:23). Another factor that poses a problem is that the expensive software is frequently imported from industrial countries and usually it is educationally and culturally incompatible to curricula in developing countries (*Ibid.*:23). Some countries may consider two or more of the rationales and then they will be faced with a more complex task of deciding on: school coverage: allocation of varying hardware and software in the different schools: and how various cadres of teachers will be trained for the different computer courses that will be offered in the schools.

Hawkrigde *et al.*'s (1990) suggestions although made more than a decade ago can still work even today because not much seems to have changed in terms of technological advancement in developing countries in particular since then. Governments, such as Lesotho are still at the beginning of formal, government-led implementation and there is still a lot that they can learn from the suggestions made by Hawkrigde *et al.* (1990).

The discussion above has briefly related policy to practice: awareness has been raised that the type of policy goals can determine the most appropriate implementation strategy in a country. This can assist decision makers on the type of hardware and software, teacher training, number of schools to be involved in the program and whether all learners in a school will be part of the program or not. The next section will discuss what ICT policy goals some of the developed and developing countries have, how the policies have been implemented in schools and what factors either encouraged or hampered effective implementation.

## **2.5 Rationale and policies in developed and developing countries**

In most countries the introduction of computers in schools was undertaken through the faith that ICTs would bring certain benefits in the education sector like in other sectors of the workforce (Kennewell, 2000). For implementation to succeed there should be clear national and school ICT policies in place to guide use (Bialobrzaska & Cohen, 2005). Clear policies, strategies and action plans in education were formulated after many years of trial and error in developed countries (Kennewell *et al.*, 2000). A scan of the countries' policies and how ICTs are used in classrooms should indicate what rationale is being emphasized as well as highlight some of the enabling factors and challenges the countries are facing.

### **2.5.1 Developed Countries**

More than 20 years ago, Bork made a prediction that computers would revolutionize the way students learn and as yet many research studies carried out in developed countries indicate that there has not been any major impact on student learning and the education system in general (Morrison *et al.*, 1999). This opinion has been expressed by many authors as has been shown in the introduction section of this chapter. The countries to be discussed below have ICT in education policies, strategies and plans. They have endeavoured to answer the question: 'Why ICTs in schools?' The challenges these countries are facing are mainly related to classroom implementation.

## **The United Kingdom**

In the UK, ICT technologies were introduced into schools in the early 80s because computers were thought to have vocational, cognitive (pedagogical) and societal benefits (Selwyn, 1999: 75). The perceived vocational benefits of computers to learners by parents and government placed much pressure on schools: and therefore, schools were intimidated into becoming current and making learners functional members of society (Selwyn, 1999:75). Perhaps, in response to these pressures and faith in the potential of ICTs to improve standards in education, the UK government has put in place policies and strategies to implement ICTs in schools and elsewhere.

Some of the first initiatives in the 1980s and 1990s were industry-driven and focused on supplying schools with ICT equipment with very little support for teachers on how it might be used (Kennewell *et al.*, 2000; Selwyn, 1999). According to Selwyn, the strategy that the UK government employed was to 'insert' ICTs into schools at whatever cost to try to keep up with the growing use of IT in other sectors of society (1999:80).

In 1990, the UK also developed its first computer-related curriculum which was seen as a subject in its own right: called IT (*Ibid.*: 8). Later on, in 1993, the curriculum was reviewed and as part of the National Curriculum it was then called ICT. It was given the status of a subject in its own right as well as being a skill spread across the curriculum (Kennewell *et al.*, 2000). To help schools achieve the demanding technology curriculum, the government through the National Curriculum Council (NCC) has provided guidance to schools. The guidance stresses that schools should have an information technology policy and a plan for its implementation (Robinson in Kearsley & Lynch, 1994).

Presently, the UK has the most notable, detailed and somehow extravagant first world ICT in education policy (Dawes, 1999). It has formulated its policy through its National Grid for Learning (NGfL) public-private partnership which has a commitment to integrate ICTs into UK schools, colleges and libraries (Selwyn, 1999:63). The UK government is in partnership with the IT industry and huge sums of money have been spent to provide coordinated, nationwide ICT use and teacher training (Dawes, 1999). The leading government partner in the strategic development and delivery of its e-strategy is BECTA (British Educational

Communications and Technology Agency). Its role is to advise the government, coordinate, provide insight through analysis and research (Cloke & Sharif, 2001).

Teaching *about* ICT occurs in all schools in the UK and it is regarded as an early stage of classroom implementation (Heppell cited in Cloke & Sharif, 2001:7). Rarely is ICT used in core areas of the curriculum (teaching *with or through* ICT) such as mathematics and science, and the number of teachers using computers in secondary schools has remained 32% for several years (Kennewell *et al.*, 2000:6). ICTs are used more frequently in professional development, personal use, and administration by secondary teachers (Williams *et al.*, 2000). Although in practice the vocational rationale is been realized in schools, both pedagogic and vocational aims are reflected in the National ICT curriculum (Watson, 2001).

The lack of clarity of the educational objectives for ICT over the last thirty years combined with lack of training of teachers have been some of the main contributing factors to the failures of the earlier initiatives in the UK (Kennewell *et al.*, 2000:7; Watson, 2001:253). Additionally, an array of problems has hindered the expected smooth adoption of the technology into schools: many of the computers in the schools were obsolete and failed to work as intended: there was little or no technical support: there was no coordinated attempt to help teachers to integrate technology into the curriculum and there was lack of equipment and resources for teachers (Selwyn, 1999:80; Dawes, 1999:235).

The majority of the obstacles above can be grouped into: Resource-related problems, teacher training issues and leadership & support. Recently, similar concerns have been raised and have been listed as factors on which schools need to evaluate their ICT performance. And these are listed as: Leadership and vision, curriculum, teaching and learning, assessment, professional development, resources and standards (BECTA, 2003). The three factors: curriculum, teaching and learning, assessment relate to classroom implementation and can be covered in professional development of teachers.

## **United States of America**

It has been established by several researchers that the main purpose of ICTs in US schools is to prepare children for the world of work: the vocational rationale (Morrison *et al.*, 1996). This is in agreement with Kearns who reported that the education sector in America has marshaled business support to integrate ICT in schools as a way to meet specialist skill needs of industry (2002:47). McMillan *et al.* (2003) have analyzed ICT policy documents and reports from the early 80s to the recent policies in the US, and have identified the main rationales for ICTs in schools as: Technology as a tool in addressing challenges in teaching and learning; Technology as a change agent; Technology as a central force in economic competitiveness. These relate to the pedagogic, catalytic and vocational rationales respectively. The last rationale also refers to the desire of the US to maintain its high standard in the IT industry.

The placing of computers in schools in the 1970s and 1980s preceded the definition of appropriate computer skills for learners in the US (Bitter cited in Barron *et al.*, 2003: 490). So there was no clarity of educational objectives for the use of IT in the US for more than 20 years similar to the situation in the UK. There has been a standards movement for many years in the US to try and establish comprehensive educational objectives. The movement culminated with the International Society for Technology Standards in Education (ISTE) in 1998 (*Ibid*: 490). ISTE published the National Education Technology Standards (NETS) for learners, followed by standards for teachers (NETS-T) in 2000 (*Ibid*). "The ISTE standards serve as the foundation for many state standards" (*Ibid*: 491). The US Department of Education has defined the baseline level competence for all students thus: "When students are able to choose and use technology tools to help themselves obtain information, analyze, synthesize, and assimilate it, and then present it in an acceptable manner, then technology integration has taken place" ( Barron *et al.*, 2003: 504).

Concurrently, the No Child Left Behind (NCLB) act was signed by President Bush in 2002. This law requires that all states should establish a system of achievement tests for learners as well as providing grants for states that meet specific requirements to integrate technology into the curriculum (*Ibid*:490). The target date for technology to be fully implemented into the curricula and instruction was 31 December, 2006 for all states (*Ibid*:490). Individually, states have also set technology benchmarks for different grade levels.

The US Department of Education released a National Education Technology Plan in 2004 as a guide for all states and districts to prepare learners for the opportunities and challenges of tomorrow. There have been other National Education Technology Plans in the previous years, the 2004 one is the latest. A set of seven action steps has been developed with accompanying recommendations. The action steps are: strengthen leadership; consider innovative budgeting; improve teacher training; support E-learning and virtual schools; encourage broadband access; move toward digital content; and integrate Data systems. The plan has been mandated by the NCLB legislation. All states have been directed by this legislation to ensure technological literacy from the eighth grade (USA, 2004).

It has been ascertained that the most commonly used software types in the classrooms in the US are mainly games, drill-and-practice, and tutorials (Morrison *et al.*, 1996: vii; Flanagan & Jacobsen, 2003: 125). Therefore, computers are used as 'toys' or 'tutors' (Taylor, 1980) and learners become engaged with the computer as a way to enrich or reinforce the curriculum (Scrimshaw, 2004:5; Barron *et al.*, 2003: 493) and this relates, in part at least, to learning *with* the computer: the pedagogic rationale. According to Morrison *et al.* the way computers were used in schools, however, does not correlate with what the students were being prepared for in the workplace, where computers are used as tools (1996: vii). This indicates that there is a gap between the intended purpose of implementation and the actual implementation. The majority of American schools are at the beginning stages of technology adoption; they are just beginning to obtain enough technology to be able to use it as a daily instructional tool (Johnson *et al.*, 1999:28). However, models of good practice are evident in some US schools and have been documented to enable schools to benchmark their capabilities against established best practice (Kearns, 2002).

Despite large spending on resources, technology integration in the US has ranged from uneven to nonexistent (Flanagan & Jacobsen, 2003). Barriers to technology integration have been summarized by Flanagan and Jacobsen into: Pedagogical issues; concerns about equity; inadequate professional development; and lack of informed leadership (2003:125).

### **Australia**

A wide spectrum of measures has been employed in developing ICT policy in Australia like in the USA and UK (Kearns, 2002:45). The Ministerial Council on Education, Employment,

Training and Youth Affairs (MCEETYA) has made a demand that schools should integrate ICTs into their curriculum to improve student learning. At the national level, an IT Skills Hub was established in 2001 and funded by the government to join industry, education and training providers to ensure industry ICT skills needs are met (*Ibid.*:45). Individually, Australian states in partnership with industry have been active in developing policies to meet ICT needs. The emphasis is on the vocational and the catalytic rationales (*Ibid.*:45).

The MCEETYA ICT in Schools Taskforce monitors the progress schools are making implementing ICT in schools goals and each year they produce a report: the Australian National Report (ANR) on schooling (ANR, 2003). The 2003 ANR report has included the national goal pertaining to ICT, stating that when students leave school they should “be confident, creative and productive users of new technologies, particularly information and communication technologies, and understand the impact of those technologies in society” (2003:2).

There are two rationales implied in the goal: the vocational and social. Using the technologies as productivity tools relate to the vocational rationale. For example, computers allow administration tasks to be performed more effectively: calculating learners’ marks can be done with ease using the spreadsheet program. And understanding the impact of the technologies on society relates to the social rationale. The report also emphasizes that there have been improvements in regard to the use of ICTs as tools: the pedagogic rationale:

Schools throughout Australia assigned a high priority to the use of ICT in teaching and learning, with broad recognition that ICT can provide powerful tools for learning across all areas of the curriculum (ANR, 2003).

The ICT course curricula vary among the jurisdictions: a number of schools offer technology-specific courses, some schools offer ICT-related vocational education and training courses and many schools offer industry-based technology courses such as those developed by international technology companies (ANR, 2003). It would seem that the Australian government has given schools the freedom to offer different ICT courses, maybe according to what works in their circumstances.

However, use of computers in Australian schools has been described by Selwyn as inconsistent (1999). Despite the different employed ICT in education strategies, the Australian government is still faced with the following challenges:

- providing teachers with professional learning opportunities to enhance their capacity to embed the use of ICT in teaching and learning, including the ways in which ICT can support assessment practices in schools:
- ensuring that university teacher training courses equip new teachers with required ICT knowledge and skills:
- securing further investment to ensure that a critical mass of quality digital content is available to schools:
- allocating sufficient recurrent funding to sustain school strategies and initiatives to ensure efficient integration of ICTs into the curriculum:
- providing all schools with access to affordable telecommunications bandwidth of sufficient capacity, reliable infrastructure and technical support:
- solving new technical challenges in areas such as security management and the integration of disparate software systems (ANR, 2003).

### **Summary of ICT implementation rationales and policies in developed countries**

Policies and strategies intended for ICT in education in developed countries seems to emphasize the vocational rationale with strong partnerships between education and industry. The general focus of policies in these countries has been focused towards long term objectives in equipping all learners with digital literacy so that specialist ICT skills can more readily be fostered on this base in the workplace (Kearns, 2002). However, there is a gap between ICT curriculum objectives and actual practice in schools in these countries.

There are strategies to improve the administration processes at the schools level and state level and these are being managed throughout the school sector. There are also certain structures in place to monitor progress in schools and document reports for the governments. The Australian ICT in Schools Taskforce, the United Kingdom's BECTA and the NCLB of the United States. The challenges of the developed countries are related to improving the strategies that are already in place to ensure integration of the technology into the curriculum. Professional development of the principal and teachers are some of the major concerns.

Resource-related issues such as security management, technical support, reliability, inequity of access, lack of resources for teachers and bandwidth capacity have been declared as additional concerns. In developing countries, however, there seems to be lack of government-led and coordinated ICT in education policies and strategies as the following discussion will reveal.

## **2.5.2 Developing Countries**

Developing countries, especially those in Africa, seem to be still struggling with documenting ICT policies and those that already have policies in place, the ICT policies are general and intended to cover all sectors of governments and not specifically the education sector. Therefore, ICT in education policies and strategies are still lacking in developing countries, partly because ICTs remain a low policy or financial priority in most educational systems in Africa (Evoh, 2007). This is understandable as African countries are faced with numerous educational challenges such as financial constraints, shortage of teachers, management challenges, marginalised access to secondary education etc. (Evoh, 2007).

### **Ghana**

Ghana has produced an ICT for Accelerated Development policy (ICT4AD) in 2003 covering all sectors in the country including the education sector. The key socio-economic development objective in education is "to increase the national capacity for industrial production and promote science and technology activities that enhance industrial productivity" (Republic of Ghana, 2003:19). There is an element of the vocational rationale implied in this objective, and the mission makes this more explicit: "to transform the educational system to provide the requisite educational and training services and environment capable of producing the right types of skills and human resources for developing and driving Ghana's information and knowledge-based economy and society" (Republic of Ghana, 2003:37). As well as the vocational rationale, there is the goal to 'transform the educational system': hence the catalytic rationale.

It seems that Ghana's ICT policy is very ambitious. The catalytic rationale demands highly skilled teachers in the field of ICT and it is very expensive to implement (Hawkrigde *et al.*, 1990), even developed countries have not attempted it practically yet, although there is some intention to do so. In the education section of the ICT policy, an intention to address the already

existing educational challenges through ICTs is expressed: the need to increase the literacy of its people and improve access to education has been stated in the policy strategies (Republic of Ghana, 2003:38).

It seems that prior to the formulation of the government ICT policy and initiatives to train personnel in the use of the technologies, ICTs had been used in many sectors in the country. Intsiful *et al.* wrote a paper in the same year that the policy was published: outlining potentials, opportunities and challenges in the implementation of ICTs in the country (Intsiful *et al.*, 2003:2).

One challenge indicated by Intsiful *et al.* was lack of clear guiding strategies and goals. The ICT policy that has been developed has at least developed a roadmap and strategies for government sectors, including education. Other challenges identified by Intsiful *et al.* (2003) can be grouped into: the unavailability of, the cost of, unreliability of the resources and lack of skilled manpower to prepare Ghana's people for the knowledge industry. Ghana's ICT policy seems to emphasize preparation of its citizens for industrial productivity and transformation of the education sector.

### **South Africa**

South Africa has developed several policy documents related to the implementation of computer use in schools. One of these policy documents, the Draft White Paper on e-Education has provided a framework for the collaboration between government and private sector initiatives (Hodgkinson-Williams, 2005:1-2). The policy document states the main goal of providing ICT in education as: "Every South African learner in the general and further education and training bands will be ICT capable (that is, use ICTs confidently and creatively to help develop the skills and knowledge they need to achieve personal goals and to be full participants in the global community) by 2013" (RSA, DoE 2004:17). The goal pertains to the social rationale when it refers to learners being 'full participants in the global community'. Another intended outcome stated in the goal is that learners should acquire skills to 'achieve personal goals'. Personal goals for learners are basically further education and ICT related careers or employment, hence in a way this refers to the vocational rationale. The vocational intention is emphasized more in the Further Education and Training (FET) curriculum statement for computer-related subjects. In the National Curriculum Statement for Grades 10-12 the purpose of the curriculum is stated as:

2.1 The subject Information Technology will enable learners to understand the principles of computing through the use of current programming language, hardware and software, and these apply to their daily lives, to the world of work and to their communities (RSA, DoE, 2004: 9).

It is evident from the quotation above that the vocational rationale, as well as the social rationale is being emphasized by the South African government.

### **Lesotho**

Lesotho has also the need to place computers in education and in schools, partly because of the pressure from parents working in other sectors of the government and computer companies wanting to make big profits in schools.

The introduction of computers in Lesotho secondary schools started sometime in the mid 80s, long before the government started initiatives to coordinate the efforts. Hence, these initial efforts of individual schools have been haphazard (Kebede, 2006:2). Another reason for the introduction of computers into schools was that computers were the latest technology that could be used for teaching and learning purposes and particularly because computers were seen to be "the latest expression of social progress" (Bowers, 2000:19).

Not only has the purchase of computers been haphazard, but curricula followed by schools were developed in an ad hoc fashion as well. Private companies usually brought with them some type of curriculum, while some schools followed the Cambridge Overseas curriculum and others hired special teachers who have decided what curriculum to use at each school.

It was this haphazard acquisition of computers and use of different ICT curricula by schools that necessitated the government to develop a certain uniform mechanism to enable schools to benefit from the resources that ICTs can offer (Kebede, 2006:2). Firstly, the government formulated an ICT policy through the department of Science and Technology in the Ministry of Communications, Science and Technology. "The policy recognizes the introduction of ICT in education as one of the significant strategies towards developing Lesotho's information technology" (Kebede, 2006:2). As yet there is no specific ICT in education policy to guide

implementation of ICTs in schools. A government of Lesotho ICT Policy document was released in March 2005 and the Minister of Science and Communications in its foreword stated that the goal of the policy is "to provide the nation with a vision and strategy for becoming a fully integrated member of the Information Society. The policy is intended to unite Government, industry, civil society and the general public in the achievement of its national development goals" (Lesotho, Govdoc, 2005:9). As yet, there is no ICT in education policy in Lesotho.

Secondly, the department of the National Curriculum Development Centre (NCDC) in the Ministry of Education Curriculum of Lesotho has developed a Computer Education Curriculum. The finished curriculum was first published in 2005, which replaced the interim "pamphlets" that previously guided teachers in the implementation of the curriculum in fourteen pilot schools from 2003 (M. Nketekete, personal conversation, May, 2006). The intention of the Computer Education curriculum is "to equip secondary students with pertinent skills for participating in the information and knowledge society" (MoE, 2005:1). The subject aims have alluded to the social, vocational and pedagogic rationales (MoE, 2005:1). Nketekete has indicated that it was anticipated that the pilot-testing of the Computer Education curriculum was to provide input into the formulation of the ICT in education policy (2006:6).

Parallel to these government initiatives, two other initiatives came to fruition between 2003 and 2005. One of these initiatives was the establishment of a Non-Governmental Organisation (NGO): SchoolNet-Lesotho, in February 2003. SchoolNet has the aim of bridging the "digital divide", supporting and promoting wider use of ICTs in Lesotho schools (Kebede, 2006:2). It was piloted in five schools in the country, but now has a membership of 16 secondary schools (Kebede, 2006:2).

The NEPAD e-school initiative which is an e-Africa Commission program conceived at the African Heads of states meeting in Lusaka in October, 2001 has launched its pilot phase in Lesotho in August 2005. The program intends to place computers and other related equipment in all primary and secondary schools in Africa within a period of ten years (African Union, 2004:8). There are 16 African countries, including Lesotho, Ghana and South Africa in the pilot phase of the project (African Union, 2004:8). NEPAD also aims to

bridge the 'digital divide' both within each country, within the continent and as well as between the continent and the rest of the world. Its purpose is to prepare Africa's youth for "active and equal participation in the information society and knowledge economy" (African Union, 2004: 8). It is envisaged that in 2010 the pilot phase will end and there will be a wider roll-out into all the secondary schools in the continent.

### **Summary of the rationales and policies in developing countries**

In the discussion of developing countries there are similarities in their ICT policies and curriculum documents. the vocational rationale is expressed in all of them. South Africa and Lesotho's policies also indicate some social rationale. Additionally, Ghana's policy includes some catalytic aspects. Strategies to implement ICTs in schools are resource-related, planned and organized outside the schools by private companies and involvement of the stakeholders in schools seems to be lacking. No documentation was found to depict what happens practically in schools, and whether or not there is a gap between the intended curricula and practiced curricula. Developing countries also lack the necessary infrastructural preconditions, such as reliable telecommunications that will enable ICT implementation in schools. Additionally, schools cannot afford the expensive ICT infrastructure. Therefore, for some years to come the ICT resources and staff development in developing countries will be outsourced as is the case in developed countries.

The three African countries discussed herein are involved in the NEPAD e-School Initiative. This Initiative is a first one of its kind in Africa. African governments, the private sector, development agencies, foundations and civil society "have come together for a common ICT project in education, developed and driven by Africans and for Africa" (Chasia cited in Evoh, 2007: 5). Perhaps the NEPAD initiative will solve the problem of the lack of government-led and coordinated ICT policies and strategies in some of these countries. Hopefully, NEPAD will also employ the private-public partnerships strategy that ensures financial support, training support, and evaluation of ICT initiatives in schools as in developed countries.

## **2.6 Chapter Summary**

The chapter commenced by establishing the reasons why governments and schools felt compelled to acquire computers by centering the discussion on Hawkridge's rationales. This discussion highlighted the reasons for school level ICT implementation. The influence of the learning theories on how computers were being used in schools as well as the benefits of using computers in teaching and learning were argued. This argument highlighted issues around classroom ICT implementation. The rationale argument was later linked to how the focus on different rationale could assist policy makers and school management on appropriate policy development and ICT implementation strategies.

The next chapter will look more closely at models of technological infusion to understand the process of implementation by outlining the key ideas underlying the adoption and diffusion of new learning technologies. The chapter will also discuss the key issues identified in this review as influencing ICT implementation in schools. The issues are: principal leadership, professional development and resource provision and they will be a focus of this study.

## **Chapter 3: Key issues pertaining to ICT implementation in schools**

### **3.1 Introduction**

The chapter commences by discussing and analyzing the concept of technology infusion by illuminating findings of several researchers as they investigated the process of ICT implementation in different countries. This will, hopefully assist me in understanding deeper the introduction of computers at the two levels of implementation: school level and classroom level. Next, three major factors affecting the innovative process of ICT implementation will be discussed, namely, principal leadership, teacher professional development and resource provision. The debate should highlight the roles of these factors and what features either enable or hinder the process of ICT implementation.

### **3.2 Models of technological Infusion**

School and classroom ICT implementation is characterized by the emergence of different patterns (models) of change as schools strive to integrate ICTs in their classroom practice across the curriculum. Johnson *et al.* have observed teachers moving from the early adoption stage of classroom implementation to a more in-depth classroom transformation in the US (1999:28). Many authors have contributed to the issue of models of change, also known as models of technological infusion.

Implementation models have been identified from research studies around the world such as the Yeun *et al.* (2003) model in a Hong Kong study; the Van Melle *et al.* (2003) model in a Canadian study; Mooij and Smeets (2001) model in a Dutch study; the Dwyer *et al.* (1991) model in an American study and UNESCO's (2002) international study model. The rationale behind the models is to define 'good practice' of ICT implementation in schools (Van Melle, 2003) so that there is a baseline level of competence being strived for (Barron *et al.*, 2003). The concept of models of good practice has been adopted in the UK and USA as a strategy to encourage innovation and change in schools. A database of exemplars of leading practice is built and supported. The EU Insight is one example of a program where case studies of 50 schools serve as

models of good practice (Kearns, 2002:111). America also has a large number of models of innovative schools (*Ibid*: 111).

However, a "magic formula" or one best practice does not exist for the successful technological infusion in schools (Van Melle *et al.*, 2003:283). What is best in one context may not necessarily be best in another context "and the fact that ICT capabilities continue to evolve and the educational environment changes, suggest that the use of ICT in teaching and learning will continue to be an emergent phenomenon" (*Ibid*: 283).

There are several developmental stages in all the models and the stages have been described with certain characteristics. The stages indicate the level of technology implementation, that is, they determine the degree with which the technology has successfully been integrated or infused into school practice and the number of stages range from three to five. The models are applicable to the implementation changes in educational systems, whole school level or teaching and learning as ICT is being gradually integrated into the curriculum.

Mooij and Smeets (2001) developed a model which explains the developmental stages at school level. The stages of their model are described as:

- Incidental and isolated use of ICT by one or more teachers
- Increasing ICT awareness throughout the school
- Building up of sufficient hardware and ICT coordination
- Ensuring enough support and didactic innovation
- Integrating ICT in teaching and learning (2001).

The first four phases were generalized from 10 case studies of ICT implementation in schools in the Netherlands, whereas the last stage is a theoretical construct of the desired last stage as this had not yet been realized in the schools (Yeun *et al.*, 2003:161). Mooij and Smeets' (2001) study focused on the technical history of ICT use in the schools, while Yeun *et al.*'s model (2003) which is also a school level ICT implementation model, focused on ICT implementation history and development in the schools (Yeun *et al.*, 2003:161). Another difference identified in the two studies is that Yeun *et al.* do not have successive stages, but have categorized the schools studied into three change models.

Yeun *et al.* developed three school-level models in their study. They were able to group the schools they studied into three clusters of characteristics pertaining to three different models of

change management observed at the schools (2003:164). They named their models: the technological adoption model, the catalytic integration model and the cultural innovation model. "The different models of change reflect the different educational values and emphasis that are deeply rooted in the history and culture of the schools presented" (*Ibid*: 168). The study has gone into the thick descriptions of the contextual characteristics of the schools. This was made possible by a small sample of schools selected for the study, but with an international study like the UNESCO study, this would have been more tedious to do.

The UNESCO model is an all encompassing model which has been developed through a study of ICT implementation in both developed and developing countries. It describes developmental stages at both the education system level, school level and teacher level (classroom level). The teacher level UNESCO model of technological infusion describes the implementation stages as: discovering ICT: understanding how and when to use ICT tools: integrating or embedding ICT across the curriculum: specializing in the use of ICT tools.

One similarity of all the models is that movement from one stage to the next is characterized by a shift from a teacher-centred to a learner-centred curriculum (Barron *et al.*, 2003): from learning *about* the technology to learning and teaching *with* and *through* the technology. Teachers progress from a focus on the technology itself because they have not as yet made a link between their subject pedagogy and aims of the technology. The focus also shifts from the use of the technology to a focus on the learners' needs in relation to ICT as well as the usual subject aims (Kennewell, Parkinson & Tanner, 2000: 99). In addition to all these characteristics of the models, Van Melle (2003) provides essential elements or conditions that have to be present in a school system to encourage a shift from one stage to the next stage of the model.

Van Melle's model will be used to develop a synthesized model because it seemed to resonate well with the conditions in the schools that participated in this study. His model has not been formulated from one aspect of implementation only, but is a holistic approach which considers essential elements that have to be in place in order to ensure sustainability regardless of a school's previous experience (Van Melle *et al.*, 2003:283). The purpose of the study is to have a holistic view of implementation issues, so that I can be a position to provide advice in this regard on as many issues as possible, so this model is also relevant beyond the immediate use in this

study. Van Melle's (2003) has three stages namely. Exploring. Expanding and Extending (**Appendix A**) which include the following essential elements:

- ICT used to enhance student learning
- ICT is an integral aspect of teaching
- Professional support is on-going
- Planning, budgeting and evaluation are key organizational activities
- ICT infusion is supported by collaborative efforts (*Ibid*: 283).

The purpose of using Van Melle's model is to see at what stage the case study schools fit within the model. However, there are other models described herein that could also provide insights into the stages of ICT introduction and implementation in schools in Lesotho, therefore a synthesis of a more detailed and relevant model to the Lesotho context will be developed later with reference to the other models. A short description of how the model will be developed follows.

The Van Melle's model will be used as a framework and the stages from other models will be located within this. The characteristics of the stages from the other models will be compared to find similarities to the Van Melle's stages and will be then be placed where they seem better suited within the model, that is, either stage 1, 2 or 3 of the model. A sample of the synthesized model is shown as **Appendix B**.

This model will be developed further to be used as a conceptual framework to discuss the findings of this study and hopefully be used subsequently as a tool for me to advise teachers in Lesotho. It could assist in determining stages at which schools are, within the broader Van Melle's model (**Appendix A**). The models have been developed in developed countries where classroom implementation has been going on for a longer time than in developing countries, so some adaptation may be needed.

### **3.3 What factors influence ICT implementation in schools?**

School level ICT implementation has been characterized by the availability of the technology in the schools (Tearle, 2004: 3) and the unavailability or shortage of computers and their peripherals has been found as a key constraint in the integration of the technology in schools (Tearle, 2004). For the last two decades, particularly in developed countries, a great deal of money has been spend on hardware, software and infrastructure with lesser amounts on teachers

and principals: the main change agents in schools (Schiller, 2003:171). From previous research in these countries it has been established that educational innovations usually do not succeed if teachers are not provided with the skills and knowledge to carry them out (Pelgrum, 2001). More important in the early adoption of innovations are the 'gatekeepers' such as school principals (Pelgrum, 2001).

### **3.3.1 Principal Leadership**

It has been argued from literature that leadership in the field of educational technology is different in many ways from leadership in general (Kearsley & Lynch, 1994). But ICT educators can learn from the available substantial literature on school effectiveness and improvement which identifies the leadership of the principal as a key factor in bringing about change (Schiller, 2003). Principal leadership is going to be discussed in the next section as to learn from both developed and developing countries and inform implementation strategies in Lesotho.

#### **3.3.1.1 Developed Countries**

##### **United Kingdom**

There is extensive research in the UK related to ICT implementation indicating the role of principal leadership, the strategies employed to inform and train principals to effectively lead the innovation in schools. In these studies factors enabling the implementation process and challenges thereof have been identified. Only a fraction of the available literature is discussed here.

In his study of UK schools, Scrimshaw found out that there were several preconditions that enabled teachers to successfully engage in innovative practice (2004:17). The role of school leadership was central in meeting some of these preconditions (*Ibid*: 17). In the most successful groups of schools, the school leaders demonstrated these roles: collaboration with teachers, support of the innovation and risk-taking, inclusion of others in decision making (*Ibid*:17). The atmosphere in these schools was such that teacher pioneers were perceived to be important and other teachers felt comfortable using ICTs (*Ibid*: 17). In these schools there is an established community of learners among staff members. External to the schools, there is a community of

learners for principals that has been created in and beyond the UK to include other countries in the European Union (Kearns. 2002).

The European Union has built a community of learners for principals to support each other as a strategy for continuous professional development of principals. A website called European Principals Online and accessed through the SchoolNet website has been established to foster exchange of information, ideas, good practice and even hints for beginning principals (Kearns, 2002:58).

Independently, the UK has established a National College for School Leadership (NCSL). The college piloted a new ICT training program for principals in partnership with BECTA, DfES (Department for Education and Skills) and Ofsted (Office for standards in education). NCSL is committed to working at a local level to understand the context of school leadership and offer relevant, practical support to school leaders in their locality (NCSL, 2007). As well as helping school leaders to tackle their unique challenges, the college shares good practice and ideas with the leaders. The training has been organized into stages to cater for the different strengths, needs and aspirations at all stages of the school leaders' careers. The stages have been named: Emergent, Established, Advanced and Consultant leadership (NCSL, 2007).

This kind of organization of the training is in agreement with Tearle's opinion that the process of ICT adoption will occur in stages over a period of time whether speeded up or not (Tearle, 2004: 23). She also notes that people's needs and expectations change as they become familiar with the technology and so this needs to be considered in the implementation process (Hall & Hord cited in Tearle, 2004:23).

ICT implementation strategies in the UK seem to be organized, controlled and funded by government as well as covering different aspects of implementation. Despite the organized, government supported strategies for principals; principals are still experiencing some mishaps in ICT implementation at the classroom level. School level policies for use of ICT are not related to more general policies and plans for learning and teaching; principals are concerned more with providing guidance, budgeting and purchase of ICT equipment and less with pedagogy and effective learning using ICT; principals are aware but not sure how to promote effective use of ICT for teaching and learning (Donneley, 2007).

## United States of America

Similar to the UK, the USA has an extensive research on principal leadership and the issues pertaining to the role, strategies to develop the principal and what enables and hinders the principal to effectively lead the ICT implementation process. The various strategies employed to equip administrators with technology leadership skills could be as a response to this extensive research.

The National Educational Technology Plan (USA, 2004) has listed steps in attaining the goal to transform education through ICTs in the US. The seven steps are listed as: strengthen leadership, consider innovative budgeting, improve teacher training, support e-learning and virtual schools, encourage broadband access, move toward digital content and integrate data systems (USA, Department of Education, 2004). Several recommendations have been made for each step of attaining the goal to transform education through ICTs. The following recommendations are made with regard to strengthening leadership:

- Invest in leadership development programs to develop a new generation of tech-savvy leaders at every level.
- Retool administrator education programs to provide training in technology decision making and organizational change.
- Develop partnerships between schools, higher education and the community.
- Empower students' participation in the planning process (USA, Department of Education, 2004).

The International Society of Technology in Education (ISTE) is an organization responsible for the technology standards movement in the US and other countries. The National Educational Technology Standards (NETS) is a project of ISTE that has developed technology standards for administrators, teachers and students. NETS has published leadership guidelines through Technology Standards for School Administrators (TSSA). TSSA has identified knowledge and skills constituting the core of what every administrator needs and should be able to do with technology (ISTE – NETS, 2000-2005). The knowledge and skills that characterize principals who effectively lead the ICT integration performing tasks that have been categorized into:

Leadership and vision: teaching and learning: productivity and professional practice: support, management and operations: assessment and evaluation: social, legal and ethical issues (*Ibid*).

### Australia

There are numerous studies of principal leadership in the implementation of ICTs in schools in Australia. The research has revealed that policies are in place in the country to ensure that principals use the technologies and they are trained to reach a certain expected level of competence. Strategies such as providing laptops for principals and setting standards of working with regional education authorities has ensured the adoption of the technologies by principals.

Schiller, in his study on principals in one urban region (NSW) of Australia has found out that they have certain challenges and concerns in regard to ICT integration in teaching and learning. There were also huge variations between principals in terms of their use of ICT, and preferences in learning about ICT (2003:183). Schiller (2003:172) has identified that principals are faced with many challenges that can be grouped into principal competencies, teacher support and resources (Table 3.2):

**Table 3. 1: Principal Challenges in Australia**

Principal competencies	Support of teachers	Resource related
The role of the principal in ICT implementation	Concerns about providing appropriate teacher training	Concerns about access and maintenance of hardware and software
Reliance on inexperienced peers and over-eager sales persons for advice.	Strategic planning for ICT integration into the curriculum	
No knowledge of actual use of ICTs by other principals		
Apprehension about personal use		

The Education and Training Department in Australia recently formulated a policy on ICT integration in schools and one of its objectives was that “by the end of 1999, all principals in the NSW government schools were required to be familiar with computerized school reporting systems and to use a personal e-mail address” (Schiller, 2003:172) provided by the department. As a result of this policy objective, the majority (93.5 percent) of principals in this region were using computers at home and at school. They used computers for the following purposes:

- Working on school newsletters, correspondence, planning and other administrative tasks at home;
- Word processing, sending and receiving e-mails and accessing the World Wide Web carried out both at home and at work (Schiller, 2003:174).

As principals underwent training and used the technologies they have indicated preferences in learning about computers and these are listed below:

- Experimenting (or playing) with a computer at home and at work;
- Getting help from a colleague or district technology advisors at the time of need;
- Targeted, short workshops with one-on-one assistance or personal tuition;
- Participation with small groups of peers and colleagues (Schiller, 2003: 182).

Certain leadership styles or roles have been identified as conducive for the effective implementation of ICTs into the curriculum. Moyle (2006) has demonstrated that those leaders who articulate a vision; model good ICT practice; drive change and remove barriers to change; secure ICT expertise etc. can effectively facilitate the integration of ICTs in teaching and learning across a school. Additionally, Schiller (2003) has illustrated that principals who were initiators, rather than managers or responders are more likely to lead their teachers to successful use of ICT in the day-to-day activities of classrooms. This suggests that training of principals should be at the forefront of ICT implementation so that principals can lead teachers in the implementation process.

### **Summary of principal leadership in developed countries**

From the study of principal leadership and ICT implementation in developed countries certain issues have come to the fore. There are certain preconditions that have to be present in a school to encourage teachers, the main implementers in a school to engage in an innovative practice such as integrating ICTs into the curriculum (Schiller, 2003). These preconditions are similar to what Yeun *et al.* refer to as the contextual characteristics of a school (2003: 164) or Van Melle *et al.*'s essential elements in ICT implementation (2003: 272). The role of the principal is critical in meeting some of these preconditions. Relating the idea of preconditions to the main research question of the study in question, I realize that the preconditions correspond to the enabling factors.

Another issue that has surfaced in this section is that the type of ICT policy and strategies enforced by government determines the extent to which principals prioritize ICT implementation in their planning. In developed countries, where ICT in education is a priority, challenges encountered by principals as they developed personal competences with ICTs, as well as when they assisted staff members and students to acquire their own skills and knowledge, are more evident. Preferences for training have also emerged as principals explored, attended training sessions and sought for help from colleagues. It is therefore, easier for governments in these countries to deploy intervention strategies to counteract the challenges emerging and hence enable progression of the ICT implementation process.

### ***3.3.1.2 Developing Countries***

The discussion that will follow will not be as detailed as in developed countries. Research on what enables principals to effectively lead the implementation process and principals' perceptions on the challenges and preferences of training was not found. What seem to be available in the three cited developing countries are the strategies for the professional development of principals.

#### **Ghana**

Ghana has established a Centre of Excellence in Information and Technology for not only Ghana's benefits but also for the West African region as a whole in 2003. The Centre is called the Ghana-India Kofi Annan Centre of Excellence in ICT and it is the first Advanced Information Technology Institute. The centre also houses West Africa's first supercomputer. It can host close to 1000 Information technology professionals, researchers, visitors and trainees at any given time. Ghana is partnered with India, a nation that is recognized as a pacesetter in the global knowledge economy. Their outreach programs are intended to demystify ICT with special groups including market women, taxi drivers, students in senior secondary schools etc. The centre is involved in several activities in the country:

- It builds networks to build beneficial partnerships
- It hosts seminars for stakeholders to share experiences and technical know-how
- It offers specialized training courses to decision-makers and important social groups such as parliamentarians.
- Cooperate training programs are offered geared to improve productivity and profits
- Working with communities to test innovative ICT solutions in different rural and urban settings (Wikipedia).

The centre seems to be committed in extensive training of all its professionals in ICTs. The Associated Schools Project Network (ASPnet) launched with the support of UNESCO's Information for All Programme (IFAP) in 2005 is another initiative in the country targeted for primary and secondary schools. There are 130 primary and secondary schools involved in the ASPnet project. Its main objective is to provide a series of ICT training courses for fifty headmasters and teachers from selected ASPnet schools. The project has also built an ICT centre with the intention to train resource persons to support the project schools (UNESCO, 2005).

ASPnet is not the only project in Ghana with the intention to provide ICT professional development to teachers including principals. The Microsoft Partners in Learning Program was established in 2004 and it is a public private partnership with the goal, among other goals to establish initially four academies for the training of professionals. There is also a program dubbed the Global e-Schools and Communities Initiative (GeSCI) established in 2003. The program's Master Plan was an answer to the earlier haphazard attempts to integrate ICTs into schools as the plan is an all encompassing program to drive all other ICT in Education Projects (Republic of Ghana, MoE, 2007). The plan proposes capacity building as one of its activities for the deployment ICTs to schools. The most recent (launched in 2005) NEPAD e-Schools Initiative also aims to provide school managers with ICT skills to enable them to facilitate the efficient management and administration of schools (Republic of Ghana, MoE, 2007).

### **South Africa**

There have been some initiatives in South Africa to support and train principals in the implementation of ICTs in schools. Two of these initiatives will be discussed. One of these initiatives is a training which has been organized into courses and presented in workshops for principals by SchoolNet South Africa. The courses have been arranged into modules and

presented in workshops which may vary in length from 1-3 hours. The modules are arranged thematically into: What principals can do with ICT, what learners and teachers do with ICT, how schools manage ICT. The courses are also suitable for provincial management educators and school management personnel (SchoolNet SA, 2003).

The other initiative is a book published by the South African Institute for Distance Education (SAIDE) to "provide support for principals and other senior managers in managing the integration of computers and related resources into teaching and learning activities in their schools" (Bialobrzaska & Cohen, 2005: 6).

Prior to the publication of the book, with the financial support from the Royal Netherlands Embassy, SAIDE undertook a study of 21 schools to investigate the use of computers for teaching and learning in schools. The findings from this research revealed that one of the reasons why ICT projects were not succeeding was that principals were not properly informed about what ICTs can and cannot do (Bialobrzaska & Cohen, 2005:6). The DoE commissioned SAIDE to produce a book for secondary school principals as a guide to the introduction of computers in schools by consolidating the knowledge that the research team had gained from the research. Some of the chapters in the book have given a detailed guidance on developing a shared vision for ICT use, strategic planning and management: implementing the vision and some practicalities such as budgeting, locating and securing computers, purchasing computers and developing and supporting staff (Bialobrzaska & Cohen, 2005:5).

### **Lesotho**

In 1996 Mathot conducted a survey of schools that used computers in Lesotho, and he identified problems that the schools offering computer studies were facing (Nketekete, 2006:4). Among the listed problems, lack of sufficiently and appropriately qualified Basotho teachers; lack of professional support by school administration were reported (*Ibid.*:4). Ten years later, in 2006, Nketekete identified the type of support received from the school and NCDC, teacher qualifications and experience as some of the factors that contributed to poor performance in Computer Education Examinations in Lesotho (2006:7). In his conclusion, Nketekete states that the factors he identified as contributing to poor performance in Computer Education in the trial schools may be addressed when the MoE develops an ICT in education policy. Hopefully, such a policy will "identify strategies and support systems necessary for implementation" (2006:14).

Nketekete also recommends that “principals should be trained on developing action-oriented school-based computer education policies” (2006:14).

Several strategies have been employed in supporting and training of principals to ensure effective implementation of ICTs in schools in developing countries. Computer literacy courses and specialized training courses have been designed and offered through workshops has been identified in Ghana and South Africa. ICT Centres have been established to assist schools; and books have been written specifically to provide support for principals. In Lesotho, none of these strategies are evident as yet. And one of the reasons for the lack of organized support and training for principals may be lack of expertise in the field of ICT in education.

### ***3.3.1.3 The Role of Principal Leadership in Implementation***

Educational leaders have always been bestowed with the responsibilities of managing change in schools, staff development and retention as well as the day-to-day administration of the school. These roles of the principal are carried out within educational policy laid down by education authorities. ICT implementation is a change with an additional burden of re-skilling and employing new staff in a school, and as such it brings with it certain challenges to the school leader.

Technology integration into the curriculum has been linked to the constructivist teaching and learning in the earlier discussion of learning theories. Drawing from the discussion of principal leadership in the various countries and also from Matthews and Crow’s conception of constructivist leadership being intimately tied to learning (2003:12), one realises that there are at least three key points to consider regarding principal leadership from a constructivist perspective. These are: The principal as a learner, the principal as a leader of learning, the principal as the manager of a technology-enabling environment.

#### **Principal as Learner**

The principal as a learner refers to the principal being actively involved in activities that will bring understanding of what the technologies are capable of at school level and classroom level. He/she has to demonstrate the desire to be an ICT learner along with teachers and learners. This involves:

- Appraising how teachers are using computers in meaningful ways with learners. The classroom experience of the use of computers with learners should familiarise the principal with the teaching and learning strategies afforded by the technology (Yeun *et al.*, 2003:127).
- Studying and communicating relevant literature about ICT in education in general. Yeun *et al.* encourage examining implementation history and development in schools to learn from more developed countries (2003:161).
- Attending principal workshops and conferences in which there is awareness raising and information on ICT integration issues. This facilitates learning from other principals and schools, locally, regionally and internationally:
- Familiarising themselves with policy documents and curricula around ICTs in Education:
- Joining or creating trend-watching groups to be alert of latest innovations and trends as well as networking with other principals, businesses and organisations online (Mason, 2005:47).

### **Principal as Leader of learning**

Using ICT in schools is strongly dependent on the school leader's vision and understanding of the role and impact of ICT in the curriculum (Yeun *et al.*, 2003:158). As a leader of learning, the principal must also be a role model and lead by example (Williams *et al.*, 2000:318). Leading by example means that the principal is seen using the technology. Price (2005); Matthews and Crow (2003); Flanagan and Jacobsen (2003) suggest specific activities:

- Initiate the development of the school's ICT vision, policies and strategic plans:
- Model and instil behaviour of lifelong learning in teachers and learners by being an adventurous learner. For example, model technology use in presentations, electronic communication of daily bulletins (Flanagan & Jacobsen, 2003: 125).
- Encourage collaboration and action research projects by teachers:
- Organise professional development events that focus on teaching and learning, both with or without ICT. Substitute teacher time for professional development:
- Arrange visits to ICT-enriched schools to learn from:
- Encourage teachers to reflect on, and make decisions about their own ICT development needs on an ongoing basis:

- Provide opportunities for teachers and learners to develop and display leadership abilities in ICT:
- Create working teams to facilitate technology integration (Matthews & Crow. 2003:12)

The principal as a leader of learning has been realised in a UK study carried out by Scrimshaw (2004). In this study it became evident that the role of the principal was critical in meeting some of the preconditions that encouraged teachers to successfully engage in innovative practice. The principal had to demonstrate skills of collaborating with teachers, support of the innovation, and inclusion of teachers in decision-making. And in Northern Ireland, the use of ICT and its role in education is an integral part of the Professional Qualification for Headship (Insight. 2005:34).

### **The principal as a manager of a technology-enabling learning environment**

Leaders have to create an environment that will enable ICT integration into the classrooms. Technology-enabled environments are the types that are favourable to “greater spread of student-centred uses of ICT” (Scrimshaw. 2004:4). In other words, this section is concerned with whether the school management offers a supportive climate for the use of ICT in the school. Practical daily activities related to ICT in the school have to reflect this kind of environment.

According to Price (2005) and Flanagan and Jacobson (2003) creating a technology-enabled environment for teachers means that principals have to:

- Provide the resources to all members of staff in order to realise the shared vision:
- Establish a technology committee with representation from parents, business, students and staff;
- Plan and fund school-wide professional staff development:
- Recruit and retain highly trained staff members e.g. highly trained librarians and computer teachers:
- Initiate and facilitate meetings between technology experts and teachers:
- Mentor and supervise classroom ICT integration by teachers (Price. 2005:56; Flanagan and Jacobsen. 2003:134).

Providing and managing resources is one of the strategies to ensure a technology-enabled environment. As a way to support leaders in managing resources, the UK government through BECTA has developed a national procurement and standards framework and specification to support decisions about effective purchasing of ICT products by school leaders (BECTA. 2007:

9). The framework ensures that the products purchased by the schools are fit for purpose and enable sustainable development. The framework has eight key elements and one of these elements is that schools are offered a range of suppliers who understand the needs of the schools (BECTA, 2007:10).

For principals to carry out these activities they also need an effective external support. The support combined with a passionate belief in the potential of ICT and the principal's "own drive to learn: to be at the front of educational experiences and activities" (Schiller, 2003:183) can promote effective school ICT implementation. It is evident that in developed countries there is robust support from the central government, local education administration and public-private partnerships. In developing countries, such as Lesotho and Ghana, coordinated ICT implementation is at its threshold and it remains to be seen what type of support will be offered to the schools.

### **3.3.2 Professional development of teachers**

Teachers' confidence, competence, trust, support and personal experience have been documented by several authors as factors that play a role in the teachers' decision to assume a positive attitude toward learning and to experiment with new ideas (Adams, 1985; Tearle, 2004; Scrimshaw, 2004).

#### **3.3.2.1 *Developed countries***

##### **The United Kingdom**

It is part of national policy to improve teachers' confidence and competence in working with ICT in the UK (BECTA, 2007:15). Therefore, the UK, like other European countries, is mandating standards of competence as an approach to pre-service training of teachers. This approach was adopted in 1998 when the country announced that all teachers should be competent in the use of ICTs (Kearns, 2002: 50). "The European Computer Driving Licence is commonly used across Europe and sets a standard for basic computer proficiency" (Kearns, 2002:49). As well as setting standards for professional development of teachers, the government provided incentives for teachers in the UK: teachers were offered a subsidy of 50 percent of the cost of a computer until in 2001 (Kearns, 2002:52). Another incentive has been providing laptops for both school and

home use, and e-mail addresses for teachers' personal use (*Ibid*: 52). This has had a large impact on raising the confidence levels of teachers (Simpson *et al.*, 2005:337).

Both in-service and newly qualified teachers have had intensive training from 2001 in the UK. The UK adopted the policy that serving teachers as well should be given the opportunity to achieve the level of ICT competence expected of newly qualified teachers (Kearns, 2002:54). The training was funded by New Opportunity Fund (NOF) in a program known as the Learning Schools Program (LSP) (*Ibid*: 54). LSP is a school-based training program, and it adopts a whole-school approach to develop effective practice in the use of ICT across all subjects. It also offers support both through local face-to-face sessions with its LSP advisers and through electronic conferencing. Teachers' responses to this program were found to be positive (*Ibid*: 55). The UK has also provided an ongoing source of information for teachers on the web: the British Teacher Training Agency. Additionally, the European SchoolNet links teachers across Europe, so that new ideas flow easily between schools and countries. (Kearns, 2002: 57).

It can be seen that the UK has not used one strategy for the training of teachers. The multiple-training and vast educational experiences shared across schools ensure that training becomes differentiated according to teacher expertise. Teachers are also able to disseminate and access examples of good practice both locally and regionally (Scrimshaw, 2004:6). This builds teachers' confidence and motivates them in using the technologies. Despite this immersion of teachers in training teachers are still at the initial stages of integrating technologies in the classrooms and ICTs are most times used for whole class sessions and not small group and individuals (BECTA Report, 2007). This has been attributed to the timing and format of the professional development failing to fulfill teachers' expectations. Another reason given for the failure of professional development is that training of the education workforce involves changing the cultures of practice: a big challenge for training providers (BECTA Report, 2007).

### **United States of America**

A number of states have mandated that new teachers should have received some degree of ICT training for licensure or certification. In addition, some states have adopted the system of identifying a number of levels of ICT competences to provide for incentives and progression for teachers. About half of the states have set some standards for ICT training of new teachers

(Kearns, 2002: 49). For in-service training of teachers the US has established systems for support services to assist teachers as well as centres of excellence as a catalyst to raising performance and standards (*Ibid.*:55).

Another strategy that the US has employed for professional development of teachers has been to define basic concepts, knowledge, skills and attitudes for applying technologies in educational contexts through the ISTE NETS for teachers (NETS-T) which were build from NETS for students. These were developed for pre-service teachers but are also used by in-service teachers. All teachers seeking certification in teacher preparation should meet these standards. Each standard is provided with performance indicators used in assessing teacher competencies (Kearns, 2004).

In his paper Kearns concludes that the United States has a long way to go in regard to professional training of teachers (*Ibid.*: 49). Warschauer is in agreement with Kearns and has identified that the main concern of teachers is not access to the technologies per se, but the way computers are used to educate children (2004:565). The concerns raised by Warschauer have been categorized into: use patterns and general education issues.

Use patterns:

- Emphasis was put on mastery of hardware or software functions rather than on underlying learning outcomes:
- Using new technologies doubled teachers' workload because they had to develop back-up lessons and materials in case something went wrong with the technologies, e.g. web sites not being accessible:
- Uses of computers were more notable in some subjects than in others (Warschauer et al., 2004: 572-577).

General education issues:

- Teachers in the low Social Education Standard (SES) schools were torn between the need to prepare learners for the high stakes exams and engaging in innovative instruction using new technologies:

- They had to teach basic computer skills during class time instead of addressing important academic materials because learners did not have computers at home like in high-SES schools:
- When low SES schools were equipped with computers and Internet connections, attention was drawn away from important resources and interventions to address serious educational challenges already facing schools, such that the emphasis on provision of ICT equipment proved to be counterproductive (Warschauer *et al.*, 2004: 585).

Where successes were evident in the integration of the new technologies into the curriculum:

- strong teacher support networks operated within the school. The support structures were made up of trained teachers (12 in the cited school) as technology facilitators, media specialists, hardware and software caretaker, students used as technology aides for networking printers and Internet connections etc.:
- extensive in-service training of teachers was available in using a range of office and educational software:
- there was a broad-based technology committee at the school. This support network was facilitated by clear channels of communication and coordinated effort (Warschauer, 2004:578).

What Warschauer has highlighted above are some enabling and constraining factors for ICT implementation in schools. The use patterns and general education issues noted seem to be impeding implementation while school-based support and training facilitate the process.

### **Australia**

Despite the large expenditure on hardware, software and infrastructure there are still concerns in Australia that ICTs have not changed how teachers teach and how learners learn (Schiller, 2003:171). Certain factors have been identified as hindering effective classroom implementation of ICTs in Australia. Clark has identified the following constraints related to use of ICTs in teaching and learning by teachers:

*Teacher Interest and Competency* - The few teachers who used the technology in the classrooms, even occasionally, were viewed by their colleagues as 'the computer person' in their schools and departments. These teachers were expected by others to serve as teacher, trainer, fix-it person,

and spokesperson and all too often, as scapegoat when there were resource limitations, parental complaints and government initiatives pushing for more technology in the schools. The few interested and competent teachers can therefore be deterred from using the technologies by non-users who are in the majority.

*Balance and continuity* – There is a problem of implementing the technology while remaining focused on subject literacy and this is because of corporations who have been increasingly aggressive in their efforts to ‘wire’ up the classrooms with permission from the state. Australian schools are directly operated by the state (2004:5).

Clark (2004) has raised two issues that seem to hamper the use of the technologies by teachers: teacher attitudes and teacher preparedness. If teachers cannot balance the new ways and old ways of teaching, then there must be something wrong with teacher professional development: maybe it does not prepare them well enough before computers are placed in classrooms.

Training of teachers has been carried out through the in-service and pre-service modes in Australia as is in the UK and the USA. States and Territories operate a range of professional learning programs for in-service teachers through a variety of delivery methods:

- Development of print-based and electronic guides for teachers
- Creation of specific ICT professional learning programs supported by websites
- Delivery of courses through face-to-face seminars and programs
- Delivery of courses online
- Use of in-school mentors or coaches (Australia. ANR. 2003).

Many schools in Australia adopted the in-school professional learning modes using ICT coaches and mentors. The leading teachers or early innovators had their direct teaching responsibilities reduced so that they can mentor and support other teachers (Australia. ANR. 2003). As well as these programs, teachers have acquired basic ICT competencies through quality digital content through different initiatives, delivery systems or portals, ICT infrastructure and collaborative projects. By the end of 2003, 90% of teachers in Australia had acquired basic competencies in using ICT (Australia. ANR. 2003). Many universities in Australia have taken specific action on the identified strategic priority that universities should be encouraged to ensure that their

graduates enter the workforce with the competencies needed, including information literacy skills and lifelong learning skills (*Ibid*). This takes care of the pre-service training. However, teachers are still faced with the following challenges:

- Developing and promoting new teaching practices that maximize student learning using ICTs:
- Using ICT as an educational tool:
- Creating opportunities for teachers to upgrade and update ICT knowledge and skills:
- Ensuring that all teacher educational programs prepare prospective teachers for the digital age, in which ICT is an important tool and is integral to student learning (Australia, ANR, 2003).

Developed countries are mandating standards of competences for both the pre-service and in-service training of teachers. The intensive and varied modes of training are accompanied by incentives to ensure increased confidence of teachers and greater impact. Despite this, there are still concerns around training and use of ICTs by teachers as has been highlighted in the three countries. The major concerns are teacher attitudes, general education issues and ensuring the number of teachers who use ICTs as an educational tool increases.

### **3.3.2.1 Developing Countries**

#### **Ghana**

Opoku has advised that there should be an aggressive human capacity building in ICT through workshops, seminars, courses in collaboration with local and international institutions (2004). There are several ICT in education initiatives in Ghana with the purpose to equip teachers with the skills to implement ICTs in the classrooms. The Ghana e-Schools and Communities Initiative (GeSCI) was specifically designed to address the haphazard attempts to integrate ICT in schools. The GeSCI Master Plan is an umbrella programme designed to drive all other ICT in education projects in Ghana (Republic of Ghana, MoE, 2006). The plan details out four broad ICT applications necessary in schools: improving teacher effectiveness is one of these applications (Republic of Ghana, MoE 2006). It is believed that teacher effectiveness can be enhanced by using ICTs in teacher administration tasks, classroom management and subject teaching and

learning (Ibid). There are several other Initiatives in Ghana that have the objectives to train teachers. and these are the NEPAD e-schools. the Kofi Annan Centre of Excellence etc.

### **South Africa**

SchoolNet South Africa manages three large teacher development programs. The programs have either been developed or customized for the South African context and contain world-class materials (SchoolNet SA. 2003). The programs are: Educator's Network, Intel Teach to the Future and Microsoft Partners of learning. These main programs cover a range of aspects of learning for teachers and these are:

- Basic computer Skills e.g. creating a class database, create a worksheet etc.
- Simple ICT integration lessons
- Project planning with ICT integration
- ICT Leadership
- Accredited ICT integration qualification: ACE

The Provincial Departments of Education and SchoolNet SA offer these courses to teachers. SchoolNet SA extends the service by offering these courses to teachers who are not even part of their Department's training schedule (SchoolNet SA. 2003).

### **Lesotho**

There has not been any government planned pre-service or in-service training of teachers in Lesotho. The NEPAD and SchoolNet Lesotho initiatives have in their plans training for teachers, but as yet have not been done on a large scale. A few teachers from the NEPAD pilot schools have been trained for a week and provided with ICT teaching and learning guides for support and reference while using computers with learners as well as performing in-house training of other teachers in their respective schools. Nketekete has carried out an investigation to find out why trial schools that had sat candidates for the first time in 2005 had such poor Computer Education examination results: 72% of all candidates failed (2006:3). The findings in this study indicated that computer teachers did not receive adequate support from the school management, NCDC and private computer business managers (Nketekete. 2006:9). Another constraint mentioned by teachers was that none of the teachers had pedagogic training but had various certificates in ICT content (Ibid: 12).

In relation to the type of support that teachers thought was necessary to have performed better in the teaching of the Computer Education subject, they identified the following:

- Procurement and purchases of adequate computer systems (both in terms of quantity and quality):
- Speedy repairs and maintenance of the system:
- In-service training and assistance on ways to teach the subject (Nketekete, 2006:10).

In relation to in-service training, teachers in the pilot schools teaching the Computer Education subject had expected NCDC personnel to have organised training on the teaching of the subject since most of the teachers did not possess any ICT pedagogic skills. Help from experienced teachers at the schools was not possible because they lacked the ICT subject content, although they had pedagogic skills (*Ibid*: 10). It would seem that a combination of ICT and pedagogic skills is necessary in classroom implementation of ICTs. It is my opinion that it would be easier to offer ICT skills to existing teachers than equipping computer teachers with pedagogic skills and this may be the reason why developed countries have taken the former direction.

In developed countries, the dominant trends in policies for professional development of teachers seem to be focused on ensuring that all teachers attain a basic level of competence in the use of ICT in education as well as encouraging continuous professional development within schools as learning communities and in collaboration with other learning communities elsewhere. In developing countries, there are not as yet established professional development policies and strategies. Teacher ICT training is through private, independent agencies such as SchoolNet SA, Microsoft Partners of Learning etc. In South Africa, the Education Department is starting to be involved in teacher professional development.

### **3.3.2.3 The Role of Professional Development in Implementation**

Tearle refers to training and support as one of the practical or 'tangible' issues important to teacher take-up and use of ICT (2004:10). The other practical factors are: availability of the technology, leadership and time (Tearle, 2004:10). Different researchers have identified the lack or insufficient training of teachers as a critical constraint with regard to implementing the technology in the classroom (Pelgrum, 2001:165). Lawson and Comber emphasize that in education unlike in other fields, it is necessary to have two sets of training for teachers: that is,

skills training and classroom integration training (2002:423). The need to differentiate training for teachers has also been identified by Howie, Muller and Paterson. (2005) and Charalambous and Karagiorgi. (2002). However, there is no one general model for teacher training: certain combinations of strategies and perspectives are likely to be effective in different contexts (Adams. 1985).

One perspective of looking at how teacher professional development can be planned is to relate the training to the roles of a teacher in the teaching and learning process. These roles have been related to the seven roles of the educator in the "Norms and Standards for Educators" in South Africa by Bialobrzaska & Cohen (2005:20). Similar to this perspective is the US' ISTE-NETS for teachers which have been designed specifically as standards in technology education. The US has defined concepts, knowledge, skills and attitudes that have to be met by both pre-service and in-service teachers before applying ICTs in teaching and learning. This type of professional development would be quite a generalized one for teachers: perhaps suitable for pre-service training. Since the introduction of computers in schools started before government initiatives to train teachers in Lesotho, and already schools are at different stages, this would not be effectively addressing the present teachers' needs.

A second perspective of looking at teacher professional development has been demonstrated in the UNESCO document (2002). Teacher professional development has been related to the ICT curriculum developed to match the stage of ICT development of each school. A teacher professional development programme that relates to each ICT curriculum and particularly to the stage of ICT integration in the school is then developed. This could be suitable for the Lesotho context, since schools introduced computers in varying years. Therefore, schools are at different stages of ICT implementation. However, there is a need for further research into the stages of development of the schools in Lesotho. The model of technological infusion to be developed by the researcher will be useful in this activity.

The third perspective in teacher training is to match the training to the main identified barriers in ICT implementation research. The planning of staff development is focused on addressing the barriers in integrating technology into the curriculum. This seems to be the trend in developed countries. Brinkerhoff and Bowdoin specifically developed an academy for teachers to "address the barriers identified as limiting the effectiveness of technology professional development"

(2006:24). A similar finding has been documented in a recent BECTA report in the UK revealing that timing and the format of teacher professional development were the main limiting factors. None of the literature studied has matched the situation in Lesotho schools as closely as the Brinkerhoff study carried out in New Mexico, in the United States of America. The barriers identified are very similar to the ones identified in the case studies in this research and they were grouped into four categories: Resource factors. Institutional and Administrative Support. Experience and Training. Teachers' attitudes (Table 3.2).

**Table 3. 2 Barriers limiting the integration of the technology into the curriculum**

<b>Resource Factors</b>	<b>Institutional &amp; Administrative Support</b>	<b>Training &amp; Experience</b>	<b>Teachers' Attitudes</b>
<ul style="list-style-type: none"> <li>• Insufficient computers, peripherals and software</li> <li>• Lack or limited Internet access</li> <li>• Slow intermittent Internet connections</li> <li>• Lack of documentation supporting integration</li> <li>• Lack of technical support and reliability of the system</li> </ul>	<ul style="list-style-type: none"> <li>• Lack of scheduling of computer-aided lessons</li> <li>• Lack of time to plan technology-infused lessons</li> <li>• Lack of time to share and collaborate with colleagues</li> <li>• No assessment of teachers' needs</li> </ul>	<ul style="list-style-type: none"> <li>• Not enough courses are available for training</li> <li>• Lack of technical-know-how by teachers</li> <li>• ICT trained teachers move to highly-paid ICT-related jobs</li> <li>• Training of teachers under-funded in schools</li> <li>• Training a once-off event</li> <li>• Lack of classroom management and organization skills of the scarce resources</li> </ul>	<ul style="list-style-type: none"> <li>• Lack of interest</li> <li>• Lack of motivation to undertake ICT-related courses</li> <li>• Computer anxiety and lack of confidence to venture into ICT use</li> </ul>

The section of the table: 'Training and experience' shows that teachers' needs are not assessed before training is organized to find out what the various teachers require. According to Brinkerhoff and Bowdin (2006), the format of the training should be in such a way that it covers technical know-how, classroom management and organization of the resources. Timing of the training is also not considered in preparation for the training: that is why the training is a once-off event.

Pelgrum in his study of developed and developing countries has concluded that there are diverse modes of staff development to meet the diverse needs of teachers. The most popular training modes for in-service teachers from the SITES-M1 study were: attending external courses.

attending in-school courses, learning via technology coordinator, learning via teachers who replicated the delivery of external courses they had attended (2003:67).

The diverse needs of teachers, the fact that ICT technologies change rapidly, and the preference of teachers for school-based, just-in-time training by colleagues within the same school necessitates in-service rather than pre-service training of teachers (Pelgrum, 2003:99). In this way, the training can be on-going and focused on the needs of the teachers at a particular time. Since pre-service training tends to be more generalized, it can only be more organized and effective once there is wide usage of the technologies in schools. Alternatively, the pre-service training can focus on the conceptual understandings of computer use in schools, not content knowledge per se.

### **3.3.3 Resources**

Unsurprisingly, availability of the technology has received much attention in schools than the previously discussed factors, that is, principal leadership and teacher professional development for ICT implementation. The availability of the technologies in schools has also been deemed the main indicator of successful implementation in schools (Tearle, 2004). Coincidentally, the key constraint in implementation of the technologies is unavailability or shortage of the technologies in schools (Tearle, 2004).

#### **3.3.3.1 Developed Countries**

##### **United Kingdom**

Government initiatives in the UK have made investments directed towards three main areas: to increase the amount of and access to up-to-date ICT equipment in schools; to improve resources, particularly online, to support classroom work; to enhance staff skills in the use of ICT to deliver the curriculum (Simpson *et al.*, 2005:337).

UK schools are relatively well equipped in terms of the ratio of computers to students (Pelgrum, 2003). Recently, in 2004, the UK government spent £1 billion on new technologies to ensure increased educational use of ICT in schools (Sutherland *et al.*, 2004:413). Despite the availability of the computers in schools there are other factors related to resources that seem to inhibit the use of ICTs in the classrooms. Tearle advised that if the following factors are not in place in

schools effective use of ICTs will be inhibited: Ease and flexibility of computer access, reliable equipment, maintenance and technical support for teachers (2004:3).

### **United States of America**

The United States is one of the leading exporter of information technology products (hardware and software) and expertise (Hawkrige *et al.*, 1990:5). The expectation is that all public sectors including schools in the US would be well equipped with the technologies “but only 12 percent of America’s schools can be classified as “high technology schools”, and only 3 percent are “target technology” schools where computers and digital technology are ubiquitous tools in the curriculum” (Johnson *et al.*, 1999:28). However, certain infrastructural items are in place in majority of schools in America: 60 percent of schools have a Local Area Network, and 70 percent have access to the Internet (Johnson *et al.*, 1999:28). Despite the well equipped schools in the USA some researchers in the US have identified the following resource- related factors which seem to discourage effective classroom implementation

- The types of technology, especially the software available, were not appropriate for classroom implementation (Morrison *et al.*, 1996:5).
- Teachers reported that the new technologies were unreliable: they did not work all the time (Warschauer *et al.*, 2004: 572).
- Equity of access: low SES schools have low access to computers while the high SES schools have better access to computers (Flanagan & Jacobsen, 2003).

It would seem that, the major concerns about the available resources in schools in both the UK and the US are reliability, suitability to purpose of use, equity and ease of access.

### **Australia**

The Department of Education and Training (DET) provides computers to schools through centrally funded programs: the Bridging the Digital Divide Initiative (BDD); the Modernization of ICT in secondary schools Initiative; IT grants; The RePC Program; provision of Notebook computers to teachers and principals and Edulibrary (DET, 2005). The BDD is a 3- year program which aims to achieve a 1:5 computer: student ratio in all government schools and improve access to the Internet through enhanced computer networking. The modernization of ICT in secondary schools initiative provides approximately 5 computers for every classroom in certain

government schools. IT grants are provided to some government schools to a total of \$7million every year to support schools to sustain and update ICT equipment. The RePC Program supplies computers and printers from government departments and industry to schools at no cost. Additionally, the DET provides notebook computers to teachers and principals in Victorian government schools. It provides and improves access to an electronic document repository called the Edulibrary. The Edulibrary consists of department-based information to teachers and principals (DET, 2005).

The DET in Australia is ensuring quantity, quality of computers, Internet access, and incentives of notebook computers for teachers, as well as supporting online information. The strategies are centrally controlled by the Department of Education; hence this may ensure use in schools to some extent unlike in Lesotho schools where the acquisition of computers by schools is optional.

### **3.3.3.2 Developing Countries**

#### **Ghana**

Information about the status of ICTs in schools in Ghana was not found, but several authors have painted a picture of the country's ICT infrastructure which may impede or encourage any ICT developments in schools.

The development of the nation's telecommunications infrastructure is essential for speeding up the process of the exploitation of ICTs in education. Generally, Ghana's physical telecommunications and communications infrastructure is under-developed and limited in coverage (Intsiful, 2002; Republic of Ghana, 2003). Additionally, high Internet subscription and running costs coupled with poor service are hampering efforts to install Internet connectivity in schools. There is also lack of effective management of network traffic and infrastructure in the country (Intsiful, 2002).

Recently, various investments in ICT infrastructure by existing Internet service providers and Telecommunication companies have been playing a major role in improving their service delivery and country coverage (Opoku, 2004). Other companies in the country have employed strategies to provide high speed access to the Internet and create IT villages at specific places with the intent to attract companies within and outside the country into ICT related industries

(*Ibid.*). In fact, there have been notable successes with regard to attracting foreign investors into the country. Several IT companies have invested in the country and they are generally satisfied with profits they are making (*Ibid.*). Recently, Ghana has signed an agreement with Microsoft Corporation, the richest ICT Company in the world, to provide resources to improve ICT in education in Ghana (*Ibid.*). NEPAD has also provided computers to some six Ghana schools through its e-school piloting initiative in 2005.

Although the challenges and strategies discussed do not reflect the status of ICT implementation in Ghana schools, they highlight the impact of some national ICT strategies on ICT implementation in schools. The low country coverage of telecommunications may lead to a few schools being supplied with the Internet if alternatives of wireless connection tend to be too expensive to install. However, the high investments of IT companies in the country may mean more companies available to donate or loan computers to schools.

### **South Africa**

In comparison to other African countries, South Africa is the best-connected African country, although 75% of its schools have no telephone lines (Kozma *et al.*, 2004:361). The national average for schools with computers in 2002 was 39.2% while the national average for schools using computers for teaching and learning was 26.5% (DoE, 2004:12).

Practically, there is a disparity in the provincial integration of ICT in education. Some provinces in South Africa have already made considerable progress in the implementation of the National ICT in education policy: these are the Western Province, the Gauteng Province and the Northern Province. They have been able to implement the policy through several projects: the Khanya Project, the Gauteng Online Project and the Connectivity Project respectively (Hodgkinson-Williams, 2005: 2). The Khanya project empowers educators to embrace technology as a means to enrich the learning experience and the Gauteng Online Project is mainly concerned with supplying ICT infrastructure to schools in partnership with the IT industry in the Gauteng province.

The Eastern Cape is an example of a province that has not implemented the ICT policy as yet. It is still grappling with development of the provincial policy. However, there are some schools in the Eastern Cape which already have computers and problems of minimal and non-use has been identified in these schools. Hodgkinson-Williams (2005) has identified that the non-use of

computers already in schools in South Africa can be linked to the absence of school policy to guide implementation. The school's ICT policy is part of a plan and it "needs to address logical aspects such as management of IT equipment (storage, safety, security) as well as use of hardware and software by staff and learners" (Bialobrzaska & Cohen, 2005:93).

### **Lesotho**

The acquisition of computers in schools in Lesotho has been a private pursuit by individual schools for many years. Most schools in Lesotho obtained computers from private companies on a hire basis, some acquired computers from donations and others purchased the equipment using school funds (SchoolNet, 2006:2). The schools that purchased or received computers from donations usually allocated most of the computers to be used for administration, teachers' record keeping and preparation purposes only. The schools that hired computers from private companies had sufficient numbers that could also extend to student use.

A government-led Initiative, NEPAD has recently placed computers in six schools as a pilot phase: computers were donated for learners, administration and teachers. The initiative intends to roll-over computers into all secondary schools in 2010. SchoolNet Lesotho, an NGO has contributed in equipping schools with computers as well. About 16 secondary schools are members of Schoolnet Lesotho and have been supplied with ten computers each.

The provision and acquisition of computers by schools has been an uncoordinated, haphazard activity by different organizations and private companies per request from schools. There is no organization, supervision and control from the central government as has been realized in developed countries. Internet connection is also very rare in Lesotho schools: in Mafeteng District: one of the ten districts in Lesotho, only one school has Internet connection at the time of writing. Other African countries discussed in this paper are experiencing a similar problem of Internet absence. "According to the UN ICT Task Force, nowhere is the digital divide more pronounced than in countries of the African continent. Africa is the most unconnected in an increasingly connected world" (Opoku, 2004).

### **3.3.3.3 The Role of Resources in Implementation**

The main concern with ICT in schools is that there is a serious likelihood of scarce resources being wasted on software and hardware that is inappropriately used or not used at all (Scrimshaw, 2004). As has already been established in the section titled 'Linking the rationale to the Implementation strategy' it is crucial that the school has a vision relating to why it needs computers in the school. This should be followed by strategic planning, which should inform the quantity and quality of ICT equipment required to meet the objectives of the school. Scrimshaw stated that the creation of a vision, needs assessment and development plan set directions and priorities, as well as decisions about the hardware, software and infrastructure required (2004:18).

With respect to resources for ICT integration in the curriculum which seems to be the ultimate goal for any ICT in schools initiative, Tearle (2004) and Wright (2000) have identified these main challenges that are faced by schools:

- The quantity and quality of the computers
- Reliability of the computers
- Access arrangements
- Location of the equipment

#### **Quantity and Quality of hardware, software and connectivity**

The student: computer ratio is an indication of the availability of the computers in a school, whereas the average percentage of computers with multimedia facilities, such as CD-ROM and a sound card indicate the quality of the equipment (Pelgrum, 2003:46-47). There are many factors that determine the decision on the quantity and quality of the infrastructure. The curriculum of the school is the main influencing factor. For example, if a school emphasizes 'Learning *through* ICT', which refers to integration of ICT into the curriculum which leads to a new transformed curriculum, then this has implications on the required quantity and quality of the ICT equipment (*Ibid.*: 26). Large quantities of ICT equipment on its own have had no significant impact on curriculum integration of the technologies as has been established in developed countries.

### **Reliability of the equipment**

If the ICT equipment in a school is unreliable it impacts on the willingness and readiness of the teachers and other staff to use it in any way (Butler & Sellbom, 2002; Tearle, 2004; Robertson *et al.*, 2005). According to Butler and Sellbom (2002) unreliability includes issues such as hardware and software malfunctions, software incompatibility, poor support services, slow Internet access and out-of-date software. Butler and Sellbom have made recommendations regarding the improvement of reliability of equipment in a school:

- It is important to convince staff about the criticality of the equipment, its integration into the curriculum and its maintenance.
- When purchasing the equipment, it is important to consider the reliability of the equipment and not the cheapest ones. If the equipment has low reliability, it will impact on the expenditure on frequent repair and earlier replacement.
- Clear lines of responsibility should be established for checking and maintaining quality control of the technologies.
- Supplies should be maintained properly as well as taking new approaches (e.g. Staff training in maintenance) to ensure rapid responses to breakdowns (2002:3).

Unreliable ICT resources has been identified and linked to impediment of classroom ICT implementation in developed countries. Warschauer (2004) in the US and Tearle (2004) in the UK have ascertained this constraint in relation to classroom implementation.

### **Access Arrangements**

Access to resources has been mentioned as a concern even in contexts where the schools were well resourced like in the UK (Tearle, 2004:18). In these well resourced contexts, staff reported the need for extra time or energy to arrange the resources. Access has shifted from being simply a shortage of equipment issue to being a deployment and use of resources issue and it is continuing to dominate discussions especially in developed countries (Tearle, 2004:18).

Kozma *et al.* in their evaluation of the World Links Program in developing countries has found out that the most cited barriers to ICT integration were not technological. Lack of time in the school day and lack of preparation time given the curriculum and examination requirements were

some of the non-technological barriers (2004:379). The lack of time was attributed to lack of priority for the use of the technology in current national and local ICT policies (*Ibid*: 379). According to the ANR (2003) Australia is one country where schools have assigned high priority to ICT use in teaching and learning. Another factor was that the use of computers was not in the curriculum in some countries and therefore there was no justification to using computers during school time (*Ibid*: 379). Lack of ICT policy and the exclusion of ICT in the school curriculum in the case study schools in Lesotho have been mentioned by teachers and principals as impeding classroom implementation.

“Enough planning and preparation time. are key to integrating ICT in our day-to-day teaching” (Scrimshaw, 2004:11). Staff, especially teachers, need sufficient time to familiarize themselves with the new technology (*Ibid*: 11). In Lesotho schools, times of access are usually scheduled for learners, but teachers have to find time in between their busy schedules or outside the school hours to use computers and this becomes an additional burden to teachers; hence they lose interest in the use of the technologies. This lack of planning is therefore, hindering the use of the technologies by teachers.

### **Location of Computers**

The placing of computers in computer laboratories has been seen as a hindrance in integrating computers into the curriculum recently in developed countries. The location of the technologies is related to access arrangements. Computers cannot be easily accessed when a need arises during a lesson: therefore teachers are not encouraged to even prepare such lessons (Morrison *et al.*, 1999:15). Times for the uses of computers have to be scheduled weeks in advance and this means they can only be used during the stipulated times which are not necessarily the times when a teacher or student in the class need them. Yee even suggests for principals that they should “deploy computers in ‘easy-access, high-use areas’ such as classrooms, libraries, hallways” (2000:298).

Although placing computers in classrooms may be a good idea for teaching purposes, it may be a security threat in schools. It is easier and cheaper to administer security measures in one place than in many different places. Therefore, in Lesotho schools, placing computers in classrooms will not be considered an option in the near future: perhaps placing computers in libraries in

addition to computer laboratories would be a better option, because library periods are placed on the school time-table in some schools.

### **3.4 Chapter Summary**

The discussion of developed countries served to highlight that the main ICT policy goals in these countries were vocational. The direction of the policies was influenced mainly by the ubiquitous computers in the workplaces and the industry-government partnerships used to 'insert' computers in majority of schools. Developing countries seem to be still struggling with developing ICT policies and the placing ICT infrastructure in schools. In some countries, including Lesotho, there are general ICT policies but no specific ICT in education policies. Policies in developing countries seem to focus on the social and vocational rationales as well. Partnerships between industry and the education sectors seem to be evident in all the selected developed countries: the industry is giving a number of commitments to support the action plans, while the education sector produces learners with a base of ICT skills from which the industry can easily foster specialist ICT skills. The major obstacle in developed countries is no longer lack of hardware: but there needs to be changes in curricula, management and organizational structures as ICTs are being integrated into the teaching and learning processes.

In both developed and developing countries there are major concerns of principal leadership, teacher training, support and resource-related issues to effectively use ICTs for teaching and learning. What has been established in the chapter is that the principal has the main roles of initiator or leader of change, modeler of technology use and supporter of teacher professional development. Certain conditions or school cultures have been found to determine the direction of ICT implementation: and this was related to the type of principal leadership at the school. Principals have expressed facing challenges in implementing ICTs in schools. Most of these challenges are associated with the lack of training of the principal and teachers. Teacher professional development is focused on providing certain prescribed ICT competences initially, providing useful resources and then supporting on-going, school-based training for teachers. This is evident in developed countries. However, in developing countries, staff development where available, is still a once-off and centre-based type of training.

Resource-related barriers to ICT implementation have been mainly associated with quality, relevance, reliability, access and technical support in developed countries rather than mainly availability and quantity as has been established in developing countries. However, the resource issues identified in developing countries still feature in developed countries.

The next chapter intends to provide a detailed description of the methodology used for the study. The methodology to be discussed has been determined largely by the problem and purpose of this study as has been outlined in chapter one and the insights and understandings gained from the intensive literature review in this chapter.

## **Chapter 4: Research Design**

### **4.1 Introduction**

The aim of the study was to establish and disseminate findings regarding the conditions and factors which facilitate or impede effective ICT implementation in schools. This was achieved by reviewing previous literature on implementation and relating it to what is happening in Lesotho schools. Questionnaires were designed to elicit detailed responses to the key research questions. Interviews and site visits to the schools were undertaken and the data that emerged was carefully analysed. This chapter aims to report the research orientation, the research design decisions and the process of collecting and analyzing data.

### **4.2 Research orientation**

The research was conducted within an interpretive orientation. According to Cohen, Manion and Morrison, the main aim of this orientation is to understand the subjective world of human experience (2000:36). The study seeks to identify the key enabling and constraining factors in the process of implementation of ICTs in schools. These factors will be identified by principals, computer teachers and teachers' responses to the questions as they recall their experiences.

A case study methodology was employed to collect and analyze the data. Understanding will be facilitated as the researcher makes a "complete description of a phenomenon [*ICT implementation*] within its context [*the school*]" (Bassey, 1999:29). Bassey's definition of a descriptive case study is characteristic of the study in question. The case study endeavours to elicit from key people what they view as enablers and constraints for the successful implementation of ICTs in their schools. The researcher has to understand from key people's experiences of planning for, acquiring and using ICTs, what they view as facilitating or hindering implementation.

One limitation of this methodology is that only 'fuzzy generalizations' (Bassey, 1999) are usually possible with a case study. This is because a case study is a study of "human behaviour, generalization from one group of people to others, or one institution to the other, is often suspect

– because there are too many elements that are specific to that group or institution” (Gillham, 2000:6). What makes a case study even more complex is that “the data and theories in the literature may have little bearing upon the ‘case’ under investigation” (Gillham, 2000:6). Additionally, a case study researcher has to be able to identify the underlying reasons which may not necessarily be spelt out by the interviewee (Gillham, 2000).

There are however, strengths of a case study research. The findings of a case study can be disseminated so as to impact upon practice as well as refining the ways in which practice is theorized (Freebody, 2003:81; Yeun *et al.*, 2003:161). Gillham has indicated that the characteristic meticulous description of a case can have an impact almost greater than any other form of research (2003:101). This is achieved as methods employed in a case study “catch unique features that may otherwise be lost in larger scale data for example, surveys), providing insights into other similar situations and cases, thereby assisting interpretation of other similar cases” (Cohen *et al.*, 2000:184). Another advantage of case studies is that they can lead to further research of issues that have emerged from the findings (Wellington, 2000:97).

The case study strategy starts from the assumption that a semi-structured interview with a small sample can provide the necessary ‘thick’ description which can enhance detailed understanding of a particular phenomenon (Bassegy, 1999). Case studies of early adopters of ICT in three Lesotho schools will be conducted because they can offer rich, in-depth data of their experience since they have been in the process for longer than others.

### **4.3 Aims**

The aims of this study are to:

- understand the prevailing enablers and constraints in ICT implementation in each of the case study schools:
- use the findings from the case studies to suggest ways in which schools can improve ICT implementation as well as inform the countrywide roll-out of the NEPAD project: and
- inform the MOE of the findings in order for them to develop suitable in-service training for teachers on the basis of the identified constraints and enablers of ICT in the studied cases.

## **4.4 Research Questions**

The main research question that frames this study is: What are enabling and constraining factors in the implementation of ICTs in secondary schools in Lesotho? Although there are a range of factors, as identified in Chapter 2, this study will limit its enquiry to three of the key factors, phrased as the following subsidiary questions:

- What role does principal leadership play in enabling or constraining the implementation of ICTs in secondary schools?
- What role does teacher professional development play in enabling or constraining the implementation of ICTs in secondary schools?
- What role does resource provision play in enabling or constraining the implementation of ICTs in secondary schools?

## **4.5 Research Design**

### **4.5.1 Consent**

Participating schools were informed via a letter to the principal (Appendix C) stating briefly what the study was about and why and how their school was selected for the study. Since two days were required for the study, two dates were suggested in the letter and the principal was to indicate whether the dates were convenient for him and other persons to be involved in the study. Since I have worked with the schools for some years, there was no need for a long introduction of myself in the letter.

The principal was asked to inform the subject teachers and computer teachers who were going to be involved in the study stating what the study was about and whether or not they would be willing to participate. Additionally, on the day that they were to answer questionnaires, participants were made aware of what the study entailed, their role in it, and how the information from the research would be disseminated. They were assured of the privacy of their contributions, confidentiality and freedom to withdraw at any time during the course of the research should they wish to.

## **4.5.2 Sample Selection**

There were two samples to be considered in the study: first, the schools to be included in the study and second, and participants to be included at each school. Considering that a case study methodology was to be employed to collect and analyze data, certain assumptions were made in the selection of the respondent sample. This strategy starts from the assumption that a semi-structured interview with a small sample can provide the necessary 'thick' description which can enhance detailed understanding of particular phenomena (Bassey, 1999). This combined with the fact that this was a small study to be confined within 100-150 pages of a thesis, only the three principals would be interviewed from the three schools. Eventually, I settled on 5 participants per school: one principal, one computer teacher and three subject teachers.

### **4.5.2.1 The schools**

The schools sampled for investigation needed to have at least a year of computer use experience to be included in the study, otherwise there would be nothing significant to gather from teachers with respect to classroom implementation. The school sample was therefore a purposeful sample, chosen for the maximum opportunity to learn about the phenomenon (Merriam, Mott & Lee, 1996:9).

In order to arrive at a list of potential schools for the study, the researcher consulted the officer in charge of Computer Education in the MOE of Lesotho who had previously undertaken a survey of all schools with computers in Lesotho and has good contacts with the schools. The Country Liaison Person for the NEPAD project in the country was also consulted to find out which NEPAD schools would be most suitable for the study. My intention as a teacher advisor was to work with at least one school in each of the initiatives mentioned above, that is, one school from the NEPAD Initiative, one school from SchoolNet and one school involved in the piloting of the National Curriculum Development Centre (NCDC) department curriculum of the MOE. I hoped this would provide a broad spectrum of the schools to learn from. Preferably, the schools also had to be within easy reach of the researcher, considering my financial limitations as the researcher. Therefore, three schools were chosen within the Mafeteng district where I stay and work. Coincidentally, the geographic locations of the schools decided on were varied: one school is located in town, another school is in a rural area and the last school is in a semi-rural area.

#### **4.5.2.2 The Respondents**

The aim of the study was to find out from key stakeholders the enabling and constraining factors in the process of ICT implementation in the schools. From the literature studied and my teaching experience, key stakeholders were identified as the principals, teachers and computer teachers. Therefore, all the three principals and computer teachers would be included in the sample. There were too many teachers to be all included in the sample, so a selection criterion was worked out for the selection of teachers. Three teachers per school would be selected in at least two subject areas: they had to be frequent computer users; they had to have been seen by the principal using computers for both personal and teaching purposes. So the teacher sample was a purposive sample. Purposive sampling involves researchers using their judgment to select participants for the specific characteristics they bring to the study (Lankshear & Knobel, 2004: 148).

Participants in the study were the principal, the staff member responsible for ICT (Computer teacher) at each school and three subject teachers so as to include specialists from as many areas of the curriculum as possible. The maximum number of participants expected was 5 at each school, that is, one principal, three subject teachers and one computer teacher and this would bring the total sample size to 15. After piloting the questionnaires in one school, I realized that there was the possibility of having more than one computer teacher at each school. There were two computer teachers at the pilot school, and I had assumed that there would be one computer teacher per school. I contacted the case study schools by phone and found out there was actually one computer teacher at School A, two at School B and three at School C. However, on the day I was supposed to collect data, one of the computer teachers at School B was not available and I could not find a third teacher to complete the questionnaire. The actual sample can best be shown in a table.

**Table 4. 3: Staff sample at each school**

	School A	School B	School C
Principals	Male. 40-49 years History and Dev. Studies	Male. 50-59 years Mathematics	Male. 50 – 59 years Languages
Computer Teacher 1	Male. 20-29	Male. 20-29	Female. 20-29
Computer Teacher 2			Female. 20-29
Computer Teacher 3			Male. 20-29*
Teacher 1	Female. 30-39 Science & Mathematics	Male. 20-29 Science & Mathematics	Male. 20-29 Science & Mathematics
Teacher 2	Female. 30-39 Geography & Dev. studies	Male. 20-29 Agriculture	Male. 20-29 Science & Mathematics
Teacher 3	Female. 30-39 Science & Mathematics		Male. 50-59 Science & Mathematics

In School A, the sample consisted of one male principal aged 40-49; one male computer teacher aged 20-29, and three female teachers aged 30-39. The sample in School B consisted of one male principal aged 50-60 years, two male teachers aged 20-29 years and one female computer teacher aged 20-29 years. The sample from School C consisted of one male principal aged 50-59, with experience of more than 10 years as a principal at the school. Two of the computer teachers were female and one was male. The three teachers at the school were all males: two of them aged between 20-29 and one around 50-60 years.

### **4.5.3 The Research environment**

The three schools are all within Mafeteng district where the researcher works as a Science Advisor for the 26 secondary or post primary schools in the district. Post primary schools in the country are usually grouped into 'Secondary' and High schools'. Secondary schools have smaller student populations and the classes are of the levels Form A up to Form C. The high schools cover all the 5 levels of secondary schooling, that is, Form A up to Form E. The case study schools are all mixed high schools with a student roll of about 600-700 learners, a teaching staff of approximately 30 teachers and an administration staff of 3-4 members.

#### **4.5.3.1 School A**

School A is a semi-urban secondary school located 2 km from Mafeteng town in the Mafeteng district which is 78 km south of the capital town, Maseru. The school has a population of 680

learners in 15 streams. 30 teachers and 4 administration staff. It has recently been nominated as a NEPAD e-school and received 25 computers and 5 printers, among other things, as a donation from Oracle Consortium through the Ministry of Education in Lesotho. According to the NEPAD e-school Country Liaison Person (CLP), the school is connected to the Internet via satellite and the staff and learners in the school can navigate the Internet as they please. Internet connectivity and costs are paid by Oracle Consortium for the pilot phase and will be paid by the school once the piloting ends. The computer teacher in the school was a subject teacher, but has been moved from teaching his subject to teaching computer literacy for both learners and teachers. The computer laboratory in the school houses 21 computers: 20 of these are shared by learners and one is used by the computer teacher. Computer literacy classes are timetabled for the first two level classes: Form A and B. Each class has two 40-minute periods per week (80 minutes per week).

#### **4.5.3.2 School B**

School B is a rural secondary school in Mafeteng district, situated about 25 km from Mafeteng town. It has a population of 600 learners, 4 administration staff and 30 teachers. There are two computers in the administration building (the secretary's office) and no computer in the principal's office. One of these computers was bought by the school in 2002 and the other one was a gift from a local company in the country as a reward to the school for having some of its learners in the country top ten in the COSC (Cambridge Overseas School Certificate) external exams. The secretary uses one of these computers and teachers are supposed to use the other one. Learners have 30 hired computers located in a computer laboratory and computer lessons are timetabled for Form A and B classes. For the Forms A and B classes there are four 40-minute lessons per week and for the rest of the classes there are two 40-minute lessons per week. There are two computer teachers at the school and both of them are paid by the computer company from which the computers are hired. The running of the computer laboratory is the sole responsibility of the company: the school merely provides the building, electricity and computer education syllabus. Payment of a security guard is also the responsibility of the school. Form A and Form B classes are following a computer education course developed by the Ministry of Education in the country, while the rest of the school is doing basic computer literacy.

#### **4.5.3.3 School C**

School C is also a semi-urban school in Mafeteng district about 20 km from town. The school has a population of about 700 learners in 16 streams, 4 administration staff and 27 teachers. There is one computer in the administration office for the secretary and 2 computers in the staffroom. The office computer was bought in 2002 by the school and the two computers in the staffroom were a gift from the bank the school uses. The computer laboratory has 50 learner computers. 38 of these computers have been bought gradually by the school, while 12 computers belong to the hired computer company. Originally, all the 50 computers belonged to the company, but every year the school buys computers through the company with the intention of owning all the computers at the end of the contract. When the school owns all the 50 computers then they will take over all tasks that are presently the responsibility of the computer company, such as paying two of the computer teachers, taking care of maintenance and training of teachers at the school. When the school is ready then the computer company will move out of the school. Presently, there are three computer teachers at the school, two are paid by the computer company and one is paid by the school. Teaching of computer literacy at the school is timetabled and there are four 40-minute lessons per week for Form C learners and three lessons for the rest of the classes.

#### **4.5.4 Data Collection Procedure**

The research is based on the case study research with multiple methods. The methods used were: semi-structured interviews, questionnaires, field notes and documentary evidence. According to Yin, a case study cannot rely on a single data collection method because of the richness of the context within which it is carried out (1993:3). The rationale for multiple-method is to ensure that there is converging evidence or triangulation (Yin, 2003:150). Cohen, Manion and Morrison define triangulation as an "attempt to map out, or explain more fully, the richness and complexity of human behaviour by studying it from more than one standpoint and, in so doing, making use of quantitative and qualitative data" (2000:233). Data was therefore, collected through various methods: questionnaires, interviews, documents and field notes to capture rich data and provide for triangulation. The data gathering activity was preceded by piloting in one of the local schools in the district.

#### **4.5.4.1 Piloting**

A pilot of the data collecting instruments was done prior to the actual data gathering for the research. Piloting is a final preparation stage for data collection (Yin, 2003). The pilot school was selected because of its accessibility and congeniality: it is a walking distance from the researcher's workplace. It is also one of the best performing schools in the district and had introduced computers for longer than the other schools in the vicinity of my workplace. It was envisaged that the school would have a reasonable and atypical amount of documentation and data (Yin, 2003). By talking to the headmistress of the school, arrangements were made to visit her school to pilot the questionnaires and the interview schedule.

The questionnaires were administered to the computer teachers (3 in this particular school) in the computer laboratory which they also use as their workplace. During the completion of the questionnaires I made field notes of what was available in the laboratory: the number of computers, the operating systems used etc. Computer teachers were able to ask for clarification where the questions tended to be a bit ambiguous.

Prior to the school visit, the researcher had assumptions about the ICT environment at the schools: that there was at least one person responsible for the computer component of the curriculum, other teachers used computers as well for their subjects. The piloting process alerted me to certain realities at the schools: teachers responsible for computer literacy in schools are called computer teachers not ICT coordinators like in most research papers I had been reading: there may be more than one computer teacher at a school: teachers are only encouraged to use computers but not forced to and this was going to affect my teacher sample in that frequent users of computers maybe possibly teachers in one subject, whereas I intended to have teachers in a variety of subjects: the use of appropriate technical language for the different types of participants I was going to work with needed to be considered. There were three computer teachers at the pilot schools. Surprisingly, one of the computer teachers at the school was also a subject (business education) teacher and she understood some of the technical terms better than other computer teachers who taught nothing else but computer literacy at the school.

This initial piloting experience with actual participants prepared me well enough for the actual research in many respects. I had to rewrite some of the questions in the computer teachers'

questionnaires to match the language to the participants. I had to increase the number of questionnaires for the computer teachers, to an expected maximum of three per school. Although consideration had been made initially to place more technical questions in the computer teachers' questionnaires only, after the piloting, some technical questions were moved from the computer teachers' to the teachers' questionnaires. The type of data sought from the participants varied from general, to technical, to subject-specific. Computer teachers were a suitable and capable group of participants for the more technical questions.

Sequentially, questionnaires were the first tools to be used in the study and were distributed to 3 subject teachers and all computer teachers at each of the three schools. Next was the writing of field notes as questionnaires were being completed. And lastly, the next day, there was a recorded interview with the principal as well as a collection of any available documents on ICT from the school.

#### **4.5.4.2 Questionnaires**

Questionnaires are best at "checking how far the researcher's hypothesis or world view is shared by the sample" (Arksey and Knight, 1999:34). They can be used to obtain information about attitudes, motivation, accounts of behaviour, opinions and events.

Collection of data commenced on the 27<sup>th</sup> July 2006 in School B which is the furthest of the three schools. The completion of questionnaires by teachers and computer teachers was carried out on the 27<sup>th</sup> July, 1<sup>st</sup> August and 3<sup>rd</sup> August 2006 in School B, School C and School B respectively. The time taken for the participants to fill-up the questionnaires ranged from 30-40 minutes.

There were two sets of questionnaires: Computer teachers' (Appendix D) and subject teachers' (Appendix E). Teachers' questionnaires were designed to provide an overview of what ICT infrastructure was available at the schools, purposes of computer use, how often they used them and what they perceive as enabling and constraining factors for effective implementation in the school or classroom. There were also questions about the principal for teachers in order to elicit his/her involvement and support for teachers and other staff in the use of computers. Computer

teacher questionnaires were intended to provide, in detail, the available infrastructure at the school as well as related topics such as allocation, location, maintenance and security of the ICT equipment. There was an element of how all these either encouraged or impeded proper implementation for each section of the questions in both the teachers and computer teachers' questionnaires.

#### **4.5.4.3 Principal Interviews**

Interviews are guided, fluid conversations to pursue a consistent line of enquiry (Yin, 2003:89). They are considered to be the most important source of information in a case study (Ibid: 89). Interviews can also gather similar data to questionnaires, but they are best at exploring these things in depth, learning about the informants' perspectives and about what matters to them" (Arksey & Knight: 34), therefore gaining an understanding of the issues. In this way, interviews are complimentary to questionnaires.

Interviews were conducted with principals on the following dates: 28<sup>th</sup> July in School B, 2<sup>nd</sup> August in School C and 4<sup>th</sup> August 2006 in School A. Interviews lasted between 40-60 minutes. The shortest interview was with the principal in School A, the youngest of the three principals. The longest was held with the principal in School C, one of the older principals. Because of his long experience of principalship (10+ years), he tended to be more elaborative than the rest of the principals and had some interesting stories to tell as well as being able to laugh at himself. Principal B, who has a relatively long (5+ years) experience in the principal position also, had some troubling issue about the way implementation of ICTs in his school had taken place. He kept on referring to the issue which surfaced as a major constraint at the school. A computer sound recorder was used to record the conversations.

As sole researcher, I conducted individual semi-structured interviews with the principals of the three schools. The semi-structured interview schedule (Appendix F) covered topics: ICT infrastructure at the school: methods of acquisition of the ICT equipment: purpose of use of the computers: professional development of staff: maintenance and security: the schools' ICT vision, policy and planning: achievements and challenges.

One purpose of the interviews was to enable a richer understanding of some of the issues raised in the questionnaire. I had a pre-prepared list of questions that guided the interview but did not tie the principals "to a fixed schedule that can limit the opportunities to enrich spoken data and gain insights into how interviewees 'see' and understand the world" (Lankshear & Knobel, 2004:202). This is the strength of unstructured and semi-structured interviews, but it poses a problem because the interview can never be repeated in exactly the same way (Lankshear & Knobel, 2004) and this resulted in the researcher not asking some of the questions because of the change of the order of asking of questions which was influenced by what the principal had said earlier.

#### **4.5.4.4 Documents**

Arksey and Knight claim that "when used with other research methods, documents can be invaluable as sources of background knowledge and for cross-checking the data" (1999:17). The documentary evidence is used mainly to corroborate information from another source and to verify names, titles or spellings of organizations that might have been mentioned in an interview (Yin, 2003:87).

The expectation was that these would include vision and mission statements, development or year plans, curricula, some reports, inventories, curricula, policies and staff development plans. Curriculum booklets were the only available documents on ICT implementation strategies at the schools. These are given to schools by the curriculum developing department in the country. From the NEPAD School there was a copy of a staff development file obtained from the principal. NEPAD organized a training workshop for few teachers (4) from each pilot school and these teachers were supposed to carry similar in-house training for the remaining teachers at the schools.

#### **4.5.4.5 Field Notes**

Taking field notes involves the researcher actually observing and recording what she sees at the school and this should serve to cross-check data obtained from the questionnaires, interviews and documents.

The data was collected over two days at each school. Teachers and computer teachers were given the questionnaires to fill in while the researcher was writing field notes. On the same day the researcher visited every place where the respondents stated there were computers to make a physical count of the computers. On the second day, the researcher collected relevant documents from schools if any and conducted principals' interviews. The field notes and documents did not provide the primary data but they assisted in the interpretation of the data. The interview questions and similarly the questions on the questionnaires were grouped into categories that would make data analysis easier later on. There were also follow-up interviews that were conducted to assist with further interpretation of the data.

#### **4.5.5 Data Analysis**

The data collected consisted both of quantitative and qualitative data. Quantitative data came mainly from the 'ICT infrastructure in schools' section of the questionnaires and was reduced into tables. Where possible, some of the numerical data in tables was translated into graphs. Some of this data was converted to percentages to try and establish the proportion of respondents that had given a particular response. The tables, graphs and percentages drawn from compiled quantitative data served to highlight significant issues for discussion.

There are many approaches of analyzing qualitative data, but the most common approach for analyzing qualitative data is coding (i.e. identifying recurring themes and ideas). Majority of the data collected in this study was qualitative. Analyzing qualitative data include several steps: Capturing, coding, categorizing, conceptualizing, and creating data (Taylor & Bogdan, 1998).

First, recorded data from principals' interview was transcribed so that it could be in a written format like other collected data. Three transcripts from the three principals were developed and labeled School A, School B and School C (Appendix G, H, I). Then capturing of qualitative data from questionnaires and transcripts was done by recording the responses of the respondents per question on a spreadsheet. This was done for computer teachers', teachers' and principals' responses separately. For every question, participants' responses were recorded and summarized. It is during the recording that patterns or themes emerged.

The emerging themes were used to group the summarized data from the worksheets into three tables. The tables were labeled: Summary of responses from computer teachers, summary of responses from teachers and summary of responses from principals (Appendix J, K, L). Each table had three columns: Theme; Enabling factor; Constraining factor. Additionally, two mind-maps were produced in order to group comments from principals' interviews into challenges and enablers.

The tables with summarized data allowed the case studies to be considered both individually and alongside each other, revealing the schools' ICT uses as well as highlighting ICT implementation strategies employed by the schools.

After I left the research sites, I continued to keep contact with the study participants using the telephone to clarify issues that arose as I wrote up the findings section of the report.

#### **4.6 Validity and Reliability**

Validity is the "extent or degree to which an inquiry, a method, a test, technique or instrument measures what it sets out or purports to measure ... Validity can be seen as a measure of the confidence in, credibility of or plausibility of a piece of research" (Wellington, 2000: 201). Validity can be measured internally or externally. Internal validity refers to how accurate the instruments were in collecting data and how logical the interpretation of the data was (Stake, 1995:108). External validity refers to the generalisability of the measurements of a study, that is, whether or not one can extend the findings to other groups or domains that have not been studied (*Ibid*:31). Wellington has stated that one can never be 100% sure of validity in an educational research, only some claim that the method or test was valid can be made (2000:30).

Certain strategies have been used to ensure validity in educational research and some of these are: triangulation and member-checking. In this study, data triangulation was used to address validity issues: data was collected using four different methods and comparison of data from different sources was compared to reach a conclusion in all sections in the discussion of the findings. Member-checking was not possible because of the distance of the researcher from the participants. This could have been done by sending the transcribed material back to the principals to read and confirm as their own. They could be encouraged to provide alternative

language or interpretation as well (Stake, 1995:115). To counteract not being able to send the interview transcript for member-checking, I contacted principals telephonically if something was not sufficiently clear.

“One of the issues is that you cannot generalise from one case, so either the case needs to be contextualised and carefully described and then others can consider its usefulness in other contexts and examples, or it is better to take a few cases, to establish a range of examples and interpretations of a situation, event or development” (Wisker, 2001:190). In this study three cases were studied and the ICT implementation phenomena compared across the cases.

Reliability can be defined as, “the judgement of the extent to which a test, a method or a tool gives consistent results across a range of settings” (Wellington, 2000:31). It refers to the extent to which a piece of research can give the same results if replicated in different contexts with different researchers. Researchers are also sceptical about total reliability of a research (*Ibid*: 31). Human behaviour is never static, so it becomes difficult to replicate qualitative data (Le Compte & Preissle Goertz, 1982:35).

#### **4.7 Chapter summary**

The chapter has discussed how the study was planned and conducted. The first step of the plan consisted of the formulation of the research goals and questions, deciding on the research orientation, identifying the relevant research methodology. The next step of the plan was to select the sample: this involved deciding on the criteria for selection of the schools and respondents, and the size of the sample. Sample selection was determined largely by the research methodology chosen and the scope of the research. Preparing different sets of questions for the different respondents followed before the actual collection of data. Once the data was collected from the respondents, it was organised into themes which determined the framework for the presentation and discussion of the data following in the next chapter.

## CHAPTER 5: Data Presentation and Discussion

### 5.1 Introduction

The process of data analysis which included using spreadsheets, tables and mind maps revealed themes and subthemes which will be used to frame the discussion in this chapter. The chapter is intended to present data in a comprehensive manner, interpreting it and providing a discussion of the findings in relation to the literature presented in earlier chapters. The data is presented in such a manner that, perspectives from the different types of respondents are highlighted on each theme and subthemes.

Three schools were involved in the study and from each of the three schools a principal, computer teacher(s) and other subject teachers were participants in the study. In this chapter, the findings are drawn from the participant interviews, questionnaires, field notes and documents in order to address the following research questions:

- 1) What is the role of principal leadership in the implementation of ICTs in schools?
- 2) What is the role of teacher development in the implementation of ICTs in schools?
- 3) What is the role of resources in the implementation of ICTs in schools?

To preserve the identity of the schools and to make the discussion easy, the following terms have been used in the chapter (Table 5.1).

**Table 5. 1: Given designations to the schools and respondents**

	<b>Principals</b>	<b>Teachers</b>	<b>Computer Teachers</b>
<b>School A</b>	Principal A	Teacher 1, Teacher 2, Teacher 3	Computer Teacher 1
<b>School B</b>	Principal B	Teacher 4, Teacher 5	Computer Teacher 2
<b>School C</b>	Principal C	Teacher 6, Teacher 7, Teacher 8	Computer Teacher 3 Computer Teacher 4 Computer Teacher 5

### 5.2 Existing ICT infrastructure at schools

Participants in the study, that is principals, computer teachers and subject teachers, were asked about what they have available in the school in terms of the quantity and quality of the ICT

infrastructure. Information about hardware, software, connectivity, facilities such as classrooms and a library, security and maintenance as related to computers was gathered. The level of sophistication of the questions increased from the principal to the teachers and finally the computer teachers because it was expected that computer teachers would know a little bit more about the infrastructure than the others. It was also expected that participants may have some ICT equipment at home and so there were questions about available ICT infrastructure at home as well.

The discussions in the next sections will occasionally refer to hired computers, and it may be necessary at this point to explain what computer hiring entails. Since schools cannot afford major purchases of computers for learners, which usually mean the purchase of 20 or more computers at a time, they hire learners' computers from commercial computer companies. The school and computer company sign some form of contract stipulating what the school should provide and what the company will provide. The computer company has to be paid for the service and money is collected from learners as computer fees. The agreements differ slightly in different schools with different companies. The following discussions of the two schools with hired computers clarify some of the differences in the agreements:

*School B* is a church school and is located on the same premises as the church, the church clinic and the pastor's house as well as the teachers' houses. The church is the school proprietor and this means that the school belongs to the church and the school has to regularly report to the church about finances, school results, employment of new teachers etc. The church has the power to either approve or disapprove the hiring of a teacher amongst others. The school had a bad experience with the computer company from which they hired computers before the present company. The company did not provide a printer in the computer laboratory; and the computer teachers did not teach the computer syllabus as expected by the school. The owner of the company refused to come to the school for discussions to resolve the matter, so the contract was terminated by the school.

The current company belongs to the pastor in the same church the school belongs to, so the company belongs to the proprietor of the school. There was no proper agreement as to what the responsibilities of the church would be and what the school's responsibilities would be with regard to managing and utilizing the ICT equipment. The payment of computer teachers, the

printer and maintenance of the computers is the responsibility of the company. And the company provided 20 used computers for learners' use. The school provided a room for the computers, provides security, electricity and the syllabus, and collects the computer levy from learners for the company. The school has no say in the running of the computer laboratory generally: the company has not accepted any suggestions from the school, for example, sharing the electricity expenses and many others. There is not even an agreement on how long the company will be at the school. Clearly, this is an unsatisfactory arrangement for the school.

*School C* on the other hand seems to be working well with the computer company they have hired to provide learners' computers. They have been working with the computer company for almost three years. The company provided the school with 50 used computers, 2 printers and 2 computer teachers (paid by the company). In addition, the company is responsible for the maintenance of the computers, technical support and training for the teachers and learners. The school had to build a room and secure a room for the computers: it pays the third computer teacher and collects the computer levy from learners for the company. The school has a share (25%) in the computer levy and uses the money to buy additional computer accessories, such as mice or cables if the need arises. The school and computer company are actually in partnership. There was also an agreement between the school and the computer company that the school should buy computers every year until all the computers that currently belong to the company would eventually belong to the school. Computers that stop functioning are also being replaced by the computer company. At the time of the interview 38 learners' computers belonged to the school already, and only 12 belonged to the company, so soon the company will be out of the school and the school will have to take over all the responsibilities of running the computer laboratory.

Both companies brought second hand computers to the schools, and it is uncertain for how many years they had already been used. Additionally, at the end of the partnership, the computers will belong to the school. The school will also be left with the responsibility of replacing the non-functioning computers. The obsolete computers may prove not to be compatible with newer software that the school might need later. The difference between the companies is that in School B, the company takes the entire computer levy, whereas in School C, the school gets a share of the computer levy.

## 5.2.1 Hardware

In this section, the total number of computers, their computer specifications and peripherals will be presented. Principals and computer teachers contributed to most of the questions in this section. Being the chief accounting officer in a school, the principal should have an overview of what is available in the school: and since the computer teacher is the ICT specialist, he/she should probably know more about what ICT equipment is available.

### 5.2.1.1 Computers and Peripherals

As can be seen in Table 5.2 the respondents in this section were principals (P) and computer teachers (CT). In the case of School C where there are three computer teachers they reported differing numbers of computers, the average of the numbers given was calculated and the average is indicated in the table. From Table 5.2 we note that School C has the most computers, between 53 & 56. School B has fewer, with between 27 & 32 and School A has the fewest with between 26 & 28. In contrast, School A has the most printers, between 5 & 6. School C has 3 printers and School B has the fewest, between 1-2 printers. Only School A has a scanner, while only School C has a camera. Both School A and C seem to have a data projector, although the computer teacher in the latter school did not confirm this.

**Table 5. 2: Number of computes and peripherals per school**

	No. Computers		No. Printers		No. Scanners		No. Cameras		Data Projectors	
	P	CT	P	CT	P	CT	P	CT	P	CT
<b>School A</b>	26	28	5	6	1	1	0	0	1	1
<b>School B</b>	32	27	2	1	0	0	0	0	0	0
<b>School C</b>	53	56	3	3	0	0	1	1	1	0

Table 5.2 indicates some contradictions in relation to the number of computers, printers and data projectors as given by principals and computer teachers: but there is generally agreement as to the number of scanners and cameras. In School B, the principal overestimated the number of computers: his number is 5 more than what the computer teacher has: the difference may have been caused by a disagreement in the number of computers for the learners (See Table 5.6, p.12). The principal may still have been referring to the original number of computers when they first came into the school and may not be aware of any computers that may have broken down or

been removed from the computer laboratory. If this is the case, then this calls for some kind of regular inventory to be put in place at the school.

The principal and computer teacher in School C did not agree about the presence of a data projector at the school. However, this could have been caused by my wording of the question. The interview question was not specific: it was phrased like this: 'Do you have a projector at the school?' and the principal answered 'Yes' to this question: and his response may have been referred to any type of projector. In the questionnaire for the computer teachers, however, the question specified 'data projector'.

During the site-visit, the researcher undertook an equipment audit. The numbers of computers and printers as shown in the first and second columns of Table 5.3 are a sum of the computers and printers located in different places in the schools. The scanners, cameras and data projectors are usually found in the administration office. The researcher's physical count for computers and printers matched the numbers given by computer teachers in School A and School C. The computer teacher in School A is well informed about what ICT equipment is available at the school because the equipment came at the same time, and was then allocated to different places in the school, probably in his presence since he is the only computer teacher at the school.

**Table 5. 3: Physical count of hardware**

	Computers	Printers	Scanners	Cameras	Data Projector
School A	28	6	1	0	1
School B	29	2	0	0	0
School C	56	3	0	1	1

Principals in School A and C have underestimated the number of computers at the schools. The difference may be attributed to the different methods of collecting data that were used for the principals and computer teachers. Principals were interviewed: and it is not easy to recall exact numbers during an interview because it is fast and interviewees do not necessarily have the relevant documents to consult during the interview. By contrast the computer teachers were given questionnaires to complete, so they had time to recall the exact numbers or even to do an actual count.

In the interviews with the principals the question on peripherals was extended by the question: 'Are the computers and peripherals adequate for your needs?' All principals indicated that they were not satisfied with the number of peripherals, but did not say much about the number of computers. Although teachers and computer teachers were not asked this question directly, in the sections of their questionnaires where they were asked to state enabling and hindering factors in relation to hardware, they also referred to some inadequacies. In School A what appeared to be the main shortages, as mentioned by the principal, are the number of printers, scanners and learner computers. However, the computer teacher in School A expressed satisfaction with the presence of the data projector ("beamer") and presence of computers in general at the school.

In School B, the principal mentioned a shortage of printers as the main inadequacy, while the computer teacher in the same school stated the absence of scanners, memory sticks and shortage of printer cartridges. However, one of the teachers in School B stated in several sections (5 times) of the questionnaire that the presence of computers and a printer at the office was an enabling factor in the use of ICTs.

In School C, the principal like the other principals was not happy with the number of peripherals in general, but in particular he mentioned problems caused by the few number of printers they have at the school during the examinations:

*But printers yes, we have a problem, only two printers (in the computer lab), I would say we need more ... particularly during examinations, we experienced a problem when we wrote. Last year I saw a problem. At one point the printers could not work, it was a lot of work for them: they broke down: we need some more (Principal C, Line 79-84).*

Conversely, in another part of the conversation, Principal C stated that he was satisfied with the number of computers and printers:

*The printers as well as the computers, I think I'm satisfied. We have computers that can match the biggest stream: we have the biggest streams in Form B where we have in each stream around 50 students, so we have no problem with the number of computers (Principal C, Line 77-79).*

The adequacy of hardware was supported by one teacher in the same school (Teacher 6) who identified sufficient computers in the laboratory as one enabling factor in the use of ICTs.

Generally, schools seem to be satisfied with the number of computers at their schools, but there is a need to have more peripherals, especially printers and to a lesser extent scanners. This may suggest that printers and scanners are used more than the other peripherals.

### **5.2.1.2 Computer specifications**

This section reports on the quality of the hardware at the schools. To establish whether the computers present at the schools could perform several uses other than just word processing, computer teachers were asked to indicate how many computers had the stated components as appears in Table 5.4. The number of computers with several components indicates the variety of functions for which the computer can be used. The presence of CD ROMS for example, means that the computers can be used to save a great deal of information, to access encyclopaedias or learning material for learners. These can be quite useful, especially in schools that are not connected to the Internet.

From Table 5.4 we notice that not all computers in the schools have all the 5 components stated. School A and C have the largest range of the devices: four out of five. School A has a total of 28 computers according to the computer teachers and of the 28 computers 25 have DVD Drives, USB Ports and Sound cards: that is, 89% of the computers at the school are supplied with three out of the five devices stated. In School A 4% of the computers have CD Writers and none have CD ROMS. School C, like School A, has the majority (84%) of its computers supplied with three of the devices. The difference is that for School C, the three devices include CD ROMS but no sound cards: so 84% of the computers have CD ROMS, DVD Drives and USB Ports. The school has a few computers with sound cards (27%) and no computers with CD Writers. Computers in School B have the lowest number of devices: two of these devices, CD ROMS and USB Ports are found in 93% of the computers in the school. Sound cards are found in only four of the computers in School B. So in terms of the quality of the computers, School B has computers of lower quality than the rest of the schools because it has fewer devices.

**Table 5. 4: Number of Computer Devices per School**

	CD ROMS	CD Writers	DVD Drives	USB Ports	Sound Cards
School A	0	1(4%)	25 (89%)	25 (89%)	25 (89%)
School B	25 (93%)	0	0	25 (93%)	4 (15%)
School C	47 (84%)	0	47(84%)	47(84%)	15 (27%)

The quality of computers in School A and School C indicate that the computers have the potential for being put to several uses. This is particularly important in integrating computers into the curriculum. My recommendation is that schools should seek technical advice in purchasing computers so that suitable computers for use can be bought for the schools. The principal in School C has indicated that they purchase computers through the computer company they are in partnership with; and it is possible that the company may not even consider suitability of the hardware for the schools' teaching and learning needs if not informed by the principal or computer teacher. This has implications on proper planning in the schools.

The presence of USB ports in the majority of computers in all the schools means that all users can easily transfer data from one computer to the next one and enable sharing of work with colleagues. since the computers in Schools B and C are not networked like in School A. The absence of CD ROMS in School A; however. means that the school cannot explore other educational material on CDs. Fortunately the school is connected to the Internet. so they can access other educational material online. although this may prove to be more expensive.

### **5.2.1.3 Location of Computers in schools**

The location of the computers should indicate how easily they can be accessed by the users. Only the computer teachers were asked: 'Where are all the computers kept in the school?' Table 5.5 gives a distribution of the computers in the different locations within the school. The table indicates that School A has placed computers in more locations than the other two schools: it has computers in 5 different places. School C has computers in a fewer number of places (3) and School B in only two (2) places. School A and C have computers in at least three different places in the school: the computer laboratory for learners, the administration office for the administration staff and the staffroom for teachers. School A has additional computers in a media centre and in the principal's office.

**Table 5. 5: Location of Computers in the schools**

	<b>Computer Lab</b>	<b>Administration</b>	<b>Staffroom</b>	<b>Media Centre/Library</b>	<b>Principal's office</b>
<b>School A</b>	✓	✓	✓	✓	✓
<b>School B</b>	✓	✓			
<b>School C</b>	✓	✓	✓		

Key: The ✓ indicates the presence of computers in the location

There is some contradiction in School C in response to this question. Principal C mentioned computers in two departments, that is, the Science/Maths department and one in the Arts Department, but the computer teachers do not mention these places in their responses. Computer teachers may not be aware of these computers because usually the administration computers and a few teacher computers have been obtained through donations or bought by the school while computers in laboratories are hired. Computer teachers spend most of their day in the computer laboratories: learners come to them for classes and they teach no other subject other than computer literacy.

School A has computers in more places (5) as compared to the other schools. This may be an enabler for the users in that they can access computers readily at different places, that is: the computers have come closer to where the users are. School A also has a computer in a media centre as well where teachers can sit quietly away from the bustle in the staffroom for serious computer-aided lesson preparations. The media centre was originally a library and it is equipped with one computer, data projector, a television set, video recorder and a white screen. However, having computers in many places may pose a security threat in that the guard cannot be at all these places at the same time, especially at night and thieves may realise this and take a chance at stealing. Putting computers in fewer places can be cost effective in terms of securing the places. Principal B mentioned that one of the two computers in the office is intended for use by teachers: but as yet the staffroom has not yet properly secured for the computer:

*... we have one for the office, the second one is for the staffroom but we haven't sent it yet because we want some level of security to be there before we do that (Principal B, Line 36-37).*

The situation in School B can be a discouraging factor for teachers wanting to use computers because they only have them in two places, the computer lab and the administration office. Although the principal in this school stated that teachers are allowed to use the office computer anytime they want to, teachers may not be comfortable working so close to the principal and deputy. In his words the principal stated that:

*You see, this office one the teachers can use every time they want, but the ones students are using for lessons they don't belong to the school so the teachers for computer studies give permission to the teachers to use when they want, that's how it goes (Principal B, line 76-79).*

The principal's statement highlights another constraining factor: teachers can only use computers in the computer laboratory when the computer teachers allow them to. So in this school, even if teachers have an interest in using computers, the location of the computers and the rules controlling the use, are not conducive for teacher use.

Both School A and C have hired learner computers: School C is in partnership with the computer company whereas in School B the computer company is the sole proprietor, so the school has no say in the running of the computer lab and associated use. The principal in School B expressed his frustration about this arrangement when I talked to him, but could not solve the problem. He expressed his frustration in these words:

*The administration does not control the use of computers wholly because it is not school property, so when the (computer) teachers are not available of course, ... If these are not there we cannot use it when those teachers are not there we cannot just authorize their use (Principal B, Line 81-84).*

In this section several enabling factors have been identified: Placing computers in different places makes accessibility by the different users easier because the computers are placed in places where the users are working most of the time, at least for teachers and administrative staff: for learners they have been placed in an accessible place where all classes can go at different times. In addition, School A has a media centre for preparation of computer-aided

lessons and presentation of the lessons using a data projector. Several constraints have emerged in this section as well: placing computers in different places is convenient for users, but is more expensive in terms of ensuring security: expecting teachers to use computers in the administration office may deter teachers from using them: sole proprietorship for ICT equipment and use is not a satisfactory option for schools.

My recommendation to schools would be that if they choose to hire a computer company for learner computers they should arrange a formal partnership with the company, so that they agree on what the company responsibilities will be and what the school's will be.

#### **5.2.1.4 Computer Allocation**

This section aims to establish how many computers are allocated to the different users: that is, administration staff, teachers and learners. In Table 5.6 we can see that the number of administrative staff is the same (4) in all the schools. School A has the highest number of computers for its administrative staff, between 2 and 3 representing a computer: staff ratio of about 1:2. School B and C both have one computer for an administrative staff of four: this represents a 1:4 computer: staff ratio. There are between 2-4 computers for teachers in Schools A and C for a teaching staff of 30 and 27 respectively: this corresponds to a computer: teacher ratio of about 1:10. School B has the fewest computers for its teaching staff: there is one computer for 30 teachers, representing a computer: teacher ratio of 1:30. The number of learners in the highest stream in Schools A and B is 60: this represents computer: learner ratios of about 1:3 and 1:2 respectively. School C has the least computer: learner ratio of 1:1

**Table 5. 6: Number of Computers per User**

	Admin.		Teachers		Learners		TOTALS	
	P	CT	P	CT	P	CT	P	CT
School A	2	3	2	4	21	20	26	28
School B	1	1	1	1	30	25	32	27
School C	1	2	2	4	50	50	53	56

The allocation of computers indicates that schools are more concerned about provision of enough ICT equipment for learners than staff members. The focus on learners has been made clear by the principals in the interviews. When asked for reasons for the introduction of computers into the schools they emphasized that this was so that learners are computer literate. In all the reasons given, teachers were never mentioned.

**Table 5. 7: Computer: User ratios for administration staff, teachers and learners**

Schools	Admin Staff	Computer: Admin. staff ratio	Teachers	Computer: Teacher Ratio	Highest No. of Learners in a stream	Computer: Learner Ratio
School A	4	1:2	30	1:15	61	1:3
School B	4	1:4	30	1:30	60	1:2
School C	4	1:4	27	1:15	50	1:1

Admin Staff = Principal, Deputy, Secretary (School A has a principal, a deputy and 2 secretaries; School B the same as A and School C has a principal, 2 deputies and 1 secretary).

It is interesting, however to notice in Table 5.6 that in all the schools all staff members and learners have been allocated some computers. The number of computers allocated to each staff member group is an indication of availability to the members of staff. Generally, the computer: administration staff ratio varies from 1:2 to 1:4: which means that one computer is shared by 2 to 4 administration staff in the three schools as shown in Table 5.7. The computer: teacher ratio varies from 1:10 to 1:30, and for learners, the computer: learner ratios vary from 1:1 to 1:3.

The highest ratios are the teachers', with 10 to 30 teachers per computer. The few numbers of computers allocated for teachers may be a cause of the low interest of teachers in using computers as indicated by principals. During the interviews principals implied that teachers can use computers in the laboratory to supplement the few numbers of computers in the staffroom:

when asked how many computers were there for the teaching staff they all mentioned the computer laboratory:

*For teaching staff there are two, besides those that are in the lab' (Principal A. line30)*

*Practically we have one for the office; the second one is for the staffroom ... though we have other computers in the computer lab; about 30 of them ... (Principal B. line 36-38)*

*For teaching staff we have a computer in each department ... So I could say two. Some teachers maybe I should add, go to the computer lab after classes if they have something to do (Principal C. line 51-53).*

But a teacher in School A indicated that most times when she wants to use computers in the laboratory there are clashes: there is usually a class in the laboratory when she has a free period. The only available time is after school hours when learners are not using the computers, which is not always a suitable time for teachers. Hiring or buying more computers for teachers in all the schools may be a solution to the problem. Principal B actually made this suggestion:

*So to solve this problem we need to buy one or two computers for teachers to use anytime they want to do their work (Line 86-87).*

Hopefully, within a few years the schools will reach a further level of implementation and then all teachers will be using computers in their subjects and computer laboratory times can be scheduled, timetabled for teachers or booked by teachers when they need to do so. Alternatively, computers can be placed in classrooms as well, so as to make accessibility even easier.

## **5.2.2 Software**

Questions on software covered operating systems, application programs and subject-specific software. Only the computer teachers were asked these questions because they are assumed to be the ones with the 'technical' know-how. It was anticipated that principals and teachers would not have answered these questions very well.

### **5.2.2.1 Operating Systems**

The question on operating systems was not answered very well. As can be seen on Table 5.8 the three computer teachers in School C agreed that their computers run on either Windows 2000 or

Windows XP: but they do not agree on the number of computers per each operating system. The computer teacher in School A indicated that 25 of the 28 (See Table 5.2) computers run on Windows XP and 2 on Windows NT. The computer teacher in School B has not named operating systems for all the computers in the school: as seen in Table 5.8 she indicated that 24 of a total of 27 (See Table 5.2) computers run on Windows XP. It is evident that the most common operating system in the three schools is Windows XP, followed by Windows 2000.

**Table 5.8: How many of the computers at school run on the following operating Systems?**

	Windows 95	Windows 98	Windows 2000	Windows NT	Windows XP	MacOS X Apple	Linux
Computer Teacher 1 School A	2			2	25		
Computer Teacher 2 School B					24		
Computer Teacher 3 School C	9		27		14		
Computer Teacher 4 School C			30		20		
Computer Teacher 5 School C			20		25		

The schools are mostly using the latest proprietary operating systems on the market and these demand certain kinds of hardware that is, fast processors with a larger memory. The Windows 2000 operating system requires a minimum of 128 MB of memory and Windows XP requires about double (256 MB) the memory for Windows 2000. The larger the memory the more expensive the computer becomes but the tasks that the computer can do increases. I believe comparison of the price of ICT equipment vis-à-vis its suitability for use requires a well-informed leadership in the school: hence principals should be technologically informed.

### 5.2.2.2 Application programs

Following the question on operating systems, computer teachers were asked what application programs they use. Table 5.9 indicates that School C has a wide range of application programs running on its computers, from *MS Office 98* to *Windows XP*. School A has just one application suite in all its computers: *MS Office 2003*. Similarly, School B has one application program in all its computers: *MS Office 2000*. The most common application suites as shown in the table are *MS Office 2000* and *MS Office 2003*.

**Table 5. 9: What application programs run on the computers?**

	MS Office 98	MS Office 2000	MS Office 2003	Windows XP
School A			✓	
School B		✓		
School C	✓	✓	✓	✓
TOTALS	1	2	2	1

The schools are locked into the use of proprietary software and they do not seem to have knowledge of cheaper open source equivalents, such as Open Office.org. While this may seem not to be an immediate problem, future Microsoft operating systems, e.g. Vista may have a tremendous impact on school finances as they may demand new and more expensive hardware. BECTA, a UK agency, has carried out an analysis of Vista and found out that there were 170 new features in the product and that it was more suitable in business rather than educational contexts. BECTA has discouraged schools and colleges in purchasing the product before the final findings report of BECTA due by January 2008 (BECTA, 2007). I think efficient advisory structures such as BECTA are necessary for schools in order to assist them in decision-making, in addition to technologically competent leaders and teachers.

### **5.2.2.3 General purpose software**

In their questionnaire, computer teachers were asked to indicate with a tick the available software for different users. Although subject teachers were not asked this question directly, in a question where they were asked to indicate how they use computers in their teaching or administration work their responses indicated what software was available at the schools. The computer teachers were given ten (10) types of software and they had to tick all those that were available at the school under different users (Table 5.10).

**Table 5. 10: Software types in the three schools**

Software Types	School A			School B			School C		
	A	T	L	A	T	L	A	T	L
1. Word processing . desktop publishing	✓	✓	✓			✓		✓	✓
2. Spreadsheet Software e.g. <i>MS Excel</i>	✓	✓	✓			✓			✓
3. Database Software e.g. <i>MS Access</i>	✓	✓	✓			✓			✓
4. Graphics	✓	✓	✓			✓			✓
5. Drill and practice programmes	✓	✓	✓						
6. Tutorial programmes. self-learning	✓	✓	✓						✓
7. Real-world simulations	✓	✓	✓						
8. Internet browser	✓	✓	✓						
9. Encyclopaedia CD-ROM	✓	✓	✓						✓
10. Presentation software e.g. <i>MS PowerPoint</i>	✓	✓	✓			✓			✓
<b>TOTALS</b>	<b>10</b>	<b>10</b>	<b>10</b>			<b>5</b>		<b>1</b>	<b>7</b>

A= Administration, T= Teachers, L= Learners

From Table 5.10. it is evident that School A has the highest number of software types: in fact it has all (10) of the provided types of software for all its users. The computer teacher in School B has only reported what is available on learners' computers: 5 types of software and these are software types 1. 2. 3. 4. and 10. The computer teachers in School C have indicated what is available on teachers' and learners' computers only. According to the computer teacher in School C there is only one type (Word processing, desktop publishing) of software in teachers' computers and seven types in the learners' computers and these are software types 1. 2. 3. 4. 6. 9. and 10. In the two schools, School B and C computer teachers do not seem to know what is available on the administration staff computers. Common software programs on learners' computers are: word processing & desktop publishing: spreadsheet: database: graphics and Internet browsing.

School A is a NEPAD school and it received its computers from the government about a year ago. NEPAD through ORACLE, have a pre-designed plan for the schools on how the computers will be used and so I conclude that providing all these programs in all the computers is part of the NEPAD implementation plan. In School B, the hired company is responsible for providing whatever it considers adequate for the computer literacy course being offered to the learners: and it seems they provide just the minimum required software because it is cheaper to do so. School

C also has a hired company responsible for providing adequate software for the computer literacy course being offered so in both schools the companies' discretion is allowed. Computers in the administration office and staff room have been obtained through donations. so computer teachers know very little about them.

From the teachers' responses to the question on how they use computers preparing for teaching or other professional activities. it became evident what application programs were available on the teachers' computers. Table 5.11 gives an indication of what tasks teachers perform on computers occasionally in the different schools.

**Table 5. 11: Tasks performed by teachers on computers**

TASKS	School	School	School	Required Software
	A	B	C	
Task A - Make worksheets or rubrics for learners	✓	✓		Word processing
Task B – Type lesson plans, notes or timetables	✓	✓	✓	Word processing, Spreadsheet
Task C – Correspond with parents or guardians				Internet browser – home & school
Task D – Record and/calculate learners' marks	✓	✓	✓	Wordprocessing, spreadsheet
Task E – Draw graphs	✓	✓	✓	Spreadsheet
Task F – Create posters, notices, invitations	✓	✓	✓	Publishing software
Task G – Develop electronic presentations or overhead transparencies	✓		✓	Presentation software
Task H – Send and receive e-mail	✓	✓		Internet browser
Task I – Search for lesson plans or websites for learners	✓			Internet browser
Task J – Exchange computer files with colleagues	✓	✓	✓	Internet browser
<b>TOTALS</b>	<b>9</b>	<b>7</b>	<b>6</b>	

Teachers in School A are able to do 9 out of the 10 tasks stated. so this is 90% of the tasks. We have already established in an earlier section that School A has all the software types that were listed in the questionnaire so it is not surprising that they can perform more tasks than teachers in other schools. Teachers in School B can perform 70% of the tasks and these are Task A. B. D.

E, F, H and J. Teachers in School C can perform the least: 60% of the tasks and these are task B, D, E, F, G, and J. Tasks B, D, E, F are common to the two schools and they require word processing, spreadsheet, graphics and desktop publishing software. Teachers in School C can also perform Task G which requires presentation software.

From the uses that teachers make of computers, one is able to deduce the software that is available for them. It is evident that they have at least five out of the ten stated software types. As learners have been provided with more software types than teachers in School A and C, this situation may encourage learners to be more computer literate than their teachers. Consequently teachers may be intimidated by learners who know more than them and not use computers with learners.

#### **5.2.2.4 Subject-specific software**

Principals in the interviews and computer teachers in the questionnaires were asked whether the school had access to any subject-related software. Although teachers were not directly asked this question, they indicated either satisfaction or disappointment with the availability of subject-specific software in their questionnaires. Only the computer teacher in School A indicated the presence of subject-related software and wrote that it is called, Oracle Learning Management Interface, which is an Integrated Learning System (ILS). Only five out of a total of eight subjects in School A are covered by the curriculum as indicated by the computer teacher: and this is in agreement with what appears in the Oracle teachers' training manual. The main features of the curriculum are provided in a manual for teachers from Oracle:

- 1) Content for the subjects. English language, Business Education, Mathematics, Physics, Chemistry and Biology (Physics and chemistry as one subject).
- 2) Laboratories for Maths, Chemistry, Physics and Biology
- 3) ICT demonstrations
- 4) Learnthings test centre (Learnthings, p.22)

In response to the question about subject-specific software two of the principals indicated its presence:

*Yes ... I think every subject besides Sesotho has content (Principal A: Line 156-158).*

*I know they are there, we bought them, and we have biology, language, one for mathematics. The only one, I'm told is being used is that one for biology, but even that one was not being used effectively (Principal C: Line 91-92).*

However, the principal in School B indicated that they had no subject-related software, but they would have in future.

In questions that required them to state enablers of subject-related software, Teacher 2 and 3 said:

*There is content provided and it is helpful specifically because it is more user friendly as compared to the information that one get from the Internet (Teacher 3, Qu.8.1).*

*It saves time for preparing experiments in the laboratory while I can just press the computer and do the experiment quickly (Teacher 2, Qu.8.2).*

*It has a lot of questions for students after every topic I do (Teacher 2, Qu. 8.2).*

When asked 'what aspects of access and use support or hinder your use of computers?' Teacher 6 in School C said that there was no appropriate software for his subjects. In another question he mentioned the use of spreadsheets to produce graphs in mathematics and physics (his subjects) and the encyclopaedia as an enabler.

In School A there is a contradiction with regard to the number of subjects covered in the subject-related software: the computer teacher and Oracle manual lists five subjects, but the principal states that every subject is covered by the software except Sesotho. During the interview, Principal A may have not been able to recall the exact number of subjects covered, whereas questionnaire completion is comparatively relaxed and the computer teacher was able to provide the correct answer. Another contributing factor may be the fact that the computer teacher is very familiar with the software, because that is his job, but the principal has a lot of things to do and cannot remember the details of the software.

It is my belief that since NEPAD, through Oracle, is developing the curriculum for several countries in Africa they had to find out what subjects were common to all the countries and then develop the curriculum accordingly. Therefore, covering all subjects in the Lesotho curriculum was not possible and it is the responsibility of the government to identify experts in the field of Computer Science and ICT in education to extend the work that has already been done by

Oracle. Teachers in the school are definitely finding the software useful in many respects, as can be seen in the quotations above and hence the more reason why the Lesotho government should carry this work further.

Computer teachers in School C gave no responses to the question on subject-specific software which means they are not aware that the school bought such software as the principal indicated in his response. The computer laboratory and computer teachers seem to be isolated from the rest of the school as is evident in this question and in earlier sections that have been discussed. This may be because most computer teachers are not qualified teachers and they do not mix well with the rest of the teaching staff. Apart from qualifications, the reason maybe these computer teachers do not regard themselves as part of the teaching staff because they are being paid by the hired computer companies in the two schools, School B and School C. But another contributing factor could be the location of the computer laboratory which is some distance away from the staffroom and office. In School A, the computer lab used to be a library, in School B, the computer lab used to be a laboratory and in School C the computer laboratory is a newly erected building and they are a little bit removed from the rest of the buildings in the school.

To round off the topic on subject-specific software, computer teachers were asked: 'Does the available software meet all your requirements?' and a summary of all the responses is in Table 5.12.

**Table 5. 12: Does the available software meet all your requirements? If not, why?**

	YES	NO + REASON
Computer Teacher 1		No. it does not cover all subjects
Computer Teacher 2	1	
Computer Teacher 3	1	
Computer Teacher 4	1	
Computer Teacher 5	1	

Four of the computer teachers were satisfied with the software at their schools and only the computer teacher at School A was not satisfied with the software because it did not cover all the subjects. School A is actually the best equipped of the three schools and it even has an ILS (integrated learning software). This software requires the networking of computers and provides

content in sequential lessons and assessment at the end of each lesson. This illustrates that a school's needs and expectations have changed because they are familiar with and have explored more technology than the other computer teachers (Tearle, 2004).

### **5.2.3 Internet connectivity**

In the computer teacher questionnaires there was a section of questions on Internet connectivity, but unfortunately these questions were answered by Computer Teacher 1 only because he was the only one in a school with an Internet connection. However, the idea of the Internet being an enabler or constraint has come up in other parts of the questionnaire from other computer teachers. Principals and teachers were also not asked this question, but similarly they raised the point of the Internet as either an enabler or constraint during the interviews. Principal C stated the absence of the Internet at the school as being unfortunate because he had an experience of using it while writing his thesis, and he indicated that learners could gain more knowledge from the Internet. Likewise, teachers in both School B and C implied having used the Internet and how it can be useful in supporting their teaching.

School A has wireless Internet connection and its speed has been described as "good" by the computer teacher. All computers at the school have been connected to the Internet and so it is available to all users in the school, that is, administration staff, teachers and learners. The availability of the Internet has been described by the computer teacher as available 24 hours a day. The principal at the school also stated that he was very proud that there was Internet connection at the school (Line 67).

Teachers in School A expressed the usefulness of Internet connectivity in statements such as:

*We have access to information that is not available in our textbooks from the Internet*  
(Teacher 1).

*I have access to Internet to find a lot of information that I need* (Teacher 2).

One teacher in School A, however, expressed his/her preference of the provided content on the ILS compared to information from the Internet:

*There is content provided and it is helpful specifically because it is more user friendly as compared to the information that one gets from the Internet (Teacher 3).*

Principal A also mentioned that although the Internet had benefited the school in some ways, he has been frustrated by some of the misuses of the Internet by teachers:

*There is a tendency to venture into stuff involving pornography and others. ... And also most people tend to focus on non-academic issues mostly and yet the project is intended to be an engine for academic excellence. ... They like to check celebrities who appear on television. I think they like such things ... (Line 102-106).*

Teachers in School B and School C have indicated that the absence of the Internet is a hindrance in their work:

*Absence of Internet; hence this hinders my teaching (Teacher 5. School B).*

*The fact that there is no Internet here, searching for information on the content, teaching methods and lesson plans becomes difficult (Teacher7. School C).*

Principals in School B and C indicated the absence of Internet connectivity at their school as one of the challenges they are facing.

*... because we don't have the ground line here for connection to the Internet ... we use mobile phones (for communication) (Principal B. line 72-74).*

*But my main worry here is, I don't have a problem with computers, the hardware or whatever we have, but I'm worried about the Internet, we are not connected to the Internet. That's a worry because I think students could gain more knowledge through the Internet (Principal C. line 66-69).*

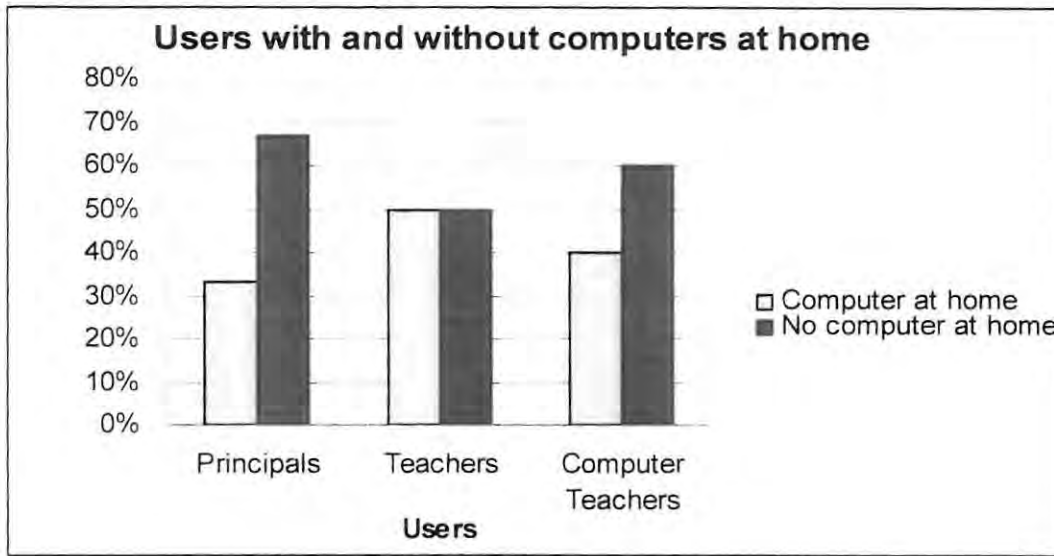
Generally the principal, subject teachers and the computer teacher in School A are happy about Internet availability at the school: they realise its usefulness. But since this school is the best equipped in terms of variety of the ICT resources compared to the other two schools, they are able to compare the different resources and decide on what is appropriate for different uses in teaching.

The few teachers in School A who have used the Internet resources have explored the different resources and they have reached a stage where they can make choices according to appropriateness of use. But principals and teachers in the other two schools can be seen to be behind in the stages of implementation, because they are still being challenged by not having certain types of ICT resources, the Internet in this case. However, it is encouraging to realise that although teachers in School B and School C have no Internet at their schools, they know what it can offer: this means that they have been exposed to the Internet elsewhere. For example, Teacher 4 from School B reported sending and receiving e-mail and Teacher 5 from the same school has indicated having exchanged computer files with colleagues. An explanation of this may be that they have computers at home with an Internet connection or they visit places with the facilities. The next section can confirm the availability of computers at the teachers' homes with an Internet connection.

### ***5.3 Existing infrastructure at home***

All participants were asked if they have computers at home and whether they were connected to the Internet at home. In addition, teachers were asked what they used the computers at home for. Figure 5.1 illustrates that there are more (66.7%) principals without computers at home than the ones with computers (33.3%) at home. A similar situation can be observed with computer teachers where a higher percentage (60%) of computer teachers has no computers at home and a smaller percentage (40%) has computers at home.

Figure 5. 1 Comparison of staff with and without computers at home



The higher percentage of teachers with computers at home compared to the other users can possibly be attributed to shortage of teacher computers at school and also to the interest the teachers have in using the equipment. The computer: teacher ratios in all the schools are equal to or greater than 1: 10. Therefore, teachers have to find ways to supplement the shortages at school by buying their own computers. The sampled teachers have been described as some of the most frequent users of computers by the principals. Their motivation levels for computer use are already high and the time they spend on school computers is insufficient for their needs: so they have bought their own computers to develop their computer skills further at home. In the question where they were asked what they are using computers at home for, they indicated that they use them for lesson preparation and administration work. Therefore, these teachers can transfer computer work from school to home and vice-versa. This is an enabling factor in the implementation process.

Unfortunately, principals and teachers were not asked whether or not they had an Internet connection at home. However, of the 40% of computer teachers with computers at home 50% have Internet access. And the principal from School C with a computer at home admitted that he was not using it: but that it was used by his son.

## 5.4 Maintenance, security and support

Most data about maintenance and security was obtained from principal interviews, computer teacher questionnaires and researcher's field notes. There were also questions in the teachers' questionnaires that asked them where they get assistance from if they come across a problem while working on computer. Technical support and other support issues will therefore be discussed in this section to illuminate the support structures present within and external to the school.

### 5.4.1 Maintenance

Computer teachers were asked whether there were any computers that were not working and why they were not working. Then next the researcher tried to find out what they did with computers that were faulty or how they troubleshoot technical problems they came across. From the principals' interviews additional information was obtained as they described technical support arrangements at the schools.

Table 5.13 provides the responses of principals and computer teachers to the questions: Are all computers at school working? If not, why are some not working? All the three principals answered yes to this question. The computer teacher in School B, however answered 'No' to the question and gave two reasons for some of the computers not working: that is dust getting into the mouse and that some computers needing reprogramming. Computer teachers in School C gave different responses to this question. Two of them answered 'Yes' to the question and one of them answered 'No' to the question and gave the reason that the C drive was damaged.

**Table 5. 13: Are all the computers at school working? If not, why are some not working?**

	Computer Teachers	Principals	Why not working?
School A	Yes	Yes	
School B	No	Yes	Dust got into mouse: Some need reprogramming
School C	2 Yes & 1 No	Yes	C drive is damaged

The data indicates that all computers in School A are working according to both the principal and the computer teacher. This is not surprising, bearing in mind that the computers at the school were hardly a year old: at the time of the interview: the principal stated that the computers were actually ten months old (Line 203). In School B not all computers were working according to the computer teacher. Contrary to this, the principal in the same school said all computers were working. Since computer teachers are closer to the computers and work with them everyday, the computer teacher's response will be considered to be the correct one. At the time of the interview, Principal B stated that the school started using computers in 2002 (Line 31), but the present company had been at the school for only six months (Line 182). Computers in School B were relatively 'new' compared to the computers in School A, but they were already having some problems. The learners' computers in School B are actually used computers according to the principal, whereas computers in School A were new computers.

There are some contradictions in the way computer teachers answered this question in School C. There could be several explanations to this, some of which are:

- The damage to the C drive is recent and the other two computer teachers have not realised it yet
- According to Principal C, two computer teachers belong to the computer company and one belongs to the school (Line 126). Maintenance is also the responsibility of the company and maybe the two teachers are trying to give an impression that the company is doing well, while the one computer teacher that belongs to the school is describing the situation correctly.

When principals were answering some of the maintenance questions during the interviews, maintenance or technical support arrangements at the three schools came to the fore, and they are illustrated in Table 5.14. From the table we can see that School A is the only school with on-site technical support, the other two schools rely on off-site technical support. The offsite technical support is found in all the schools and it is scheduled in School A and School C. In School B the offsite support is on the basis of request when need arises. We can also note from the table (Table 5.14) that the offsite technical support is very far for School A compared to the other two schools, hence it is often delayed: it does not come immediately and as often as indicated for School B and School C respectively.

**Table 5. 14: Technical support arrangements in schools**

	On-site	Off-site	Scheduled?	How far?	Need Arises	Comments
<b>School A</b>	Yes	Yes	Yes – 2 per year	S.Africa (Oracle)	No	The maintenance is <b>delayed</b>
<b>School B</b>	No	Yes	No	30 km	Yes	Technician comes <b>immediately</b> when called
<b>School C</b>	No	Yes	Yes 1/mnth Or wkly	100km	Yes	The technician comes <b>often</b>

The computer teacher at the school has the technical-know (line125) as stated by Principal A. Since the implementation process in School A was better planned as will be illustrated in a later section unlike in the other two schools. the school may have been advised to hire somebody with a technical know-how since technical help would not be readily available. The other two schools do not necessarily need onsite technical help because the technicians are not far from the schools: they can visit the schools regularly as is the case in School C. The technical support in School B is not even scheduled like in the other schools since the technician is quite close and there is no need to schedule the visits since the technician is only 30 km away. Generally, the three schools have adequate technical assistance: hence the ICT equipment at the schools is well maintained.

As schools plan ICT implementation it would be useful to include in their plans technical support arrangements with the companies concerned. Likewise, in the Ministry of Education ICT training plan there should be a section on technical support, as this has a potential to frustrate schools if not put in place from the beginning.

#### **5.4.2 Security**

Principals and computer teachers were asked questions about security. The questions tried to establish what security measures had been put in place in the places where the schools have computers. As we can see in the Table 4.15 several security measures have been employed. All the schools have at least three security measures in place and these are burglar proofing, floodlights, and security guards. The principals reported more security measures than computer

teachers although the questions were open-ended for both of them. School A has the highest number of security measures (6) than the other schools which each have 4 security measures in place.

**Table 5. 15: What security measures have you employed at places where computers are kept?**

	Burglar Proofing		Floodlights		Guards		Locks		Alarms		Passwords	
	P	CT	P	CT	P	CT	P	CT	P	CT	P	CT
School A	✓		✓		✓	✓	✓		✓		✓	
School B	✓	✓	✓		✓							✓
School C	✓	✓	✓		✓	✓	✓					
<b>TOTALS</b>	3	2	3		3	2	2		1		1	1

School A was able to employ more security measures because there were minimum security requirements set by NEPAD that the school had to meet before the equipment could be delivered to the schools. The NEPAD Country Liaison Person in the country stated that it was also agreed that once the computers were at the schools armed security guards would have to be put in place. At the time of collecting data at School A there was no armed security guard as yet. The school has had an ordinary unarmed watchman for many years.

In addition, principals were asked whether they were satisfied with the maintenance and security measures in their schools and two of them: Principal B and Principal C responded yes to the question while Principal A indicated that there was still room for improvement. He responded by saying:

*I think we still have to go an extra mile, by way of installing alarms and contracting fully qualified security guards (Line 145-146).*

ICT equipment is very expensive: hence there is a need to ensure the highest standards of security. Unfortunately, security measures increases the cost of the equipment.

## **5.5 Support**

There is a need for teachers and other staff members to ask for technical support as they learn new computer skills. But it has been found that technical support is not the only kind of support required by teachers as they try to improve their own knowledge, understanding and practical skills. Institutional and administrative: peer and collaborative: technical and external support have been identified in this study to be either enabling or impeding the ICT implementation process.

### **5.5.1 Institutional and Administrative Support**

To ascertain whether teachers and computer teachers had received any institutional and administrative support several questions were asked on 'Professional Support' (Question 5) and 'Teacher Support' (Question 6). These were intended to establish whether teachers were gaining support in their ICT-related work or individual needs respectively. But support issues also surfaced in responses to other sections of the questionnaire. Institutional support refers mainly to managerial issues, that is, organisational strategies put in place to guide and control ICT use in the schools. These managerial strategies were organised into: ICT vision/policy, planning and budgeting, and timetabling or scheduling of access. Administrative support refers to practical day-to-day ICT operations of the school. These have been organised into technical support, provision of resources and peer and collaborative support.

#### **5.5.1.1 Vision and Policy**

When asked to suggest what aspects of access and use either support or hinder their use of computers, 12.5% of teachers responded that lack of policy on accessibility of computers for teaching purposes hindered their computer use in teaching (Qu.4.9). The same number of teachers also indicated that lack of a policy on cross-curricular use of ICT is a hindrance in their use of ICTs in teaching (Qu.3.4). The lack of an ICT policy and timetable clashes were also given as reasons for not having access to computers every time teachers wanted to use them for teaching (Qu.4.6). These responses indicated that some teachers were eager for ICT to be included in the curriculum, but were prevented from doing so by the lack of clear policies. In fact, 75% of teachers have expressed the desire that ICT should be included in the curriculum.

They were also certain that that this would not interfere with their usual regular teaching workload, for example, covering of the syllabus (Qu.8.4).

There is no written vision and policy in all the schools, and teachers are not aware of the principals' long term vision. However, all principals expressed their visions during the interviews. In response to the question: "Why did your school start using computers?" all principals stated that the main reason for the introduction of computers into their schools was so that all learners would be computer literate. Other reasons stated were to improve the administration efficiency (Principal B, line 99); increase the chances for employability of the learners at the end of their schooling (Principal B, line 201) and to apply computer skills in other subjects (Principal C). Principal A also mentioned that their school (NEPAD School) was carrying out the mission espoused by the African leaders through NEPAD (Line 195- 197):

The NEPAD e-Schools Initiative will ensure that the majority of the people on the continent will have the skills and knowledge required to function and participate as equals in the information society and knowledge economy of the 21<sup>st</sup> century (NEPAD Dialogue, 2004: 9).

School A can formulate its policy using the NEPAD vision, mission, strategies and the Lesotho ICT policy as foundations. The other schools can also refer to these documents to formulate their school ICT vision and policies as well. But more importantly, professional development of the school leaders to be aware of the educational benefits and approaches in different circumstances would be an added advantage. Assuming that the schools had some formulated ICT vision and policies then some strategic planning would automatically follow.

### ***5.5.1.2 Planning and Budgeting***

Planning can be described as those strategies put in place to assist staff and other persons to efficiently implement the school's ICT vision either in the school as a whole or in the classroom. Some important aspects for classroom implementation are the type of ICT curriculum to be used and teacher training plan. Budgeting refers to some financial plan to obtain resources for implementation.

Although no principal mentioned a written plan during the interviews, it was found out later that at least there is a guide for teachers and computer teachers for using computers with learners in one school. In School A there is a comprehensive training manual for teachers which incorporate digital curriculum content for 62.5% of subjects in the school's curriculum. Every teacher in this school has been provided with the training manual (Principal A) by the Oracle team which guides teachers in the use of the provided computer applications (and television) with learners.

A study of the contents of the manual by the researcher revealed that the manual provides guidelines for teachers in the following areas: Computer literacy: Integrating the digital curriculum content and ICTs into teaching; Creating a personal website and e-mail for the teachers' use and learners' use: using the television in teaching and learning.

#### **5.5.1.3 Timetabling/ Scheduling of Access**

There is a schedule of access in the three schools for the classes that have been selected to attend computer literacy classes, that is, Forms A and B. But in none of the schools is scheduling of access arranged for teachers' use of computers with learners for curriculum integration. This lack of provision on the timetable for teachers to use computers in their subject areas with learners has been mentioned as a constraint by 25 % of the sampled teachers. The schools administration needs to consider the inclusion of subject-related ICT lessons on the timetable if learners are to apply ICT skills into subjects, as asserted by Principal C as one of the objectives of introducing ICTs in School C.

#### **5.5.1.4 Technical Support**

According to principals, all computers were working at their respective schools at the time of the interview: indicating that technical support was efficient: computer teachers' responses indicated otherwise (see section 5.4.1). Most (80%) computer teachers have computer problem-solving skills: they have indicated that they can apply some trouble-shooting techniques. The reliable, local offsite technical support combined with computer teachers who have basic trouble-shooting skills in Schools B and C seems to be a satisfactory technical support arrangement. Although in School A, the computer teacher has some basic technical know-how, the offsite technical expert makes the technical support arrangement at this school somewhat inefficient.

### **5.5.1.5 Provision of Resources**

One way that the administration can support staff in ICT implementation is by providing adequate ICT resources. The administration can put in place strategies such as budgeting for the purchase of hardware and resources. Classroom implementation support material such as curriculum documents, subject-specific software and teachers' guides also need to be provided by the administration. According to principals and computer teachers there is no annual budgeting for ICT equipment or staff training in all the three schools. In School A, the principal explained that there was no major budgeting since the Oracle Consortium was providing almost everything required for the ICT curriculum done at the school; however, there was provision for this kind of budget in the technical subjects department in the school. In School B, the principal and computer teacher have indicated that there is no annual budget for hardware, software and training of teachers, but this would be considered towards the end of the contract with the computer company at the school. However, the school had the responsibility to pay for electricity and the security guard. Principal C explained that it was not easy to construct a budget for the ICT equipment because payment of the computer levy by the learners has proved to be unpredictable over the years.

### **5.5.1.6 Peer and Collaborative support**

The value of peer support has been identified among teachers, computer teachers and learners. Teachers have identified the support they receive from other teachers as an enabler in the use of ICTs. In a question in which they were asked: 'in using ICTs, more often than not one needs assistance. Who do you get help from?' The options were: Principal, computer teacher, technician, another teacher, student, other. Most (75%) teachers in School A and C indicated getting assistance from the computer teachers. The next popular option was assistance from other teachers (37.5%). Teachers in School B did not indicate any assistance from the computer teachers and other teachers. To emphasize this point they chose the 'other' option: Teacher 4 wrote 'not applicable' and Teacher 5 wrote 'myself'. Therefore, there is an indication of the presence of peer support amongst teachers in Schools A and C and none in School B. The major form of collaborative support is computer teachers assisting teachers. One teacher from School A has also mentioned the principal being supportive all the time.

There is also evidence of peer support amongst learners in School C. When teachers were asked, 'who troubleshoots learners' ICT problems?' A small percentage (12.5%) of teachers in School C indicated other learners as troubleshooting other learners' computer problems. From the teachers' perspective, there is also collaboration between computer teachers and learners as well as between teachers and learners as learners encounter problems.

There is also peer support between computer teachers, although this was not the most popular option with computer teachers: selected by 40% of computer teachers. Computer teachers seem to be more comfortable with not asking for help from anybody: 80% selected 'Problem-solve myself'. Asking for help from the offsite IT technician was also selected by 40% of computer teachers. In their response to the experience question (Qu.2.1), it was established that 80% of computer teachers have computer experience of 5-6 years and 20% have an experience of 10+ years in using computers. Their experiences match some of the teachers' and it would seem it might be possible for them to learn a few things or get assistance from teachers if they requested. This line of collaboration seems to be only one-way: that is teachers asking for help from computer teachers and not vice-versa. It is the role of the principal to establish an atmosphere that is conducive for collaborative and peer learning and this has been identified by Scrimshaw (2004) as an enabling precondition for teachers to engage in successful innovative practice.

### **5.5.2 External support**

Principals and Computer teachers are the ones who deal directly with external people to the schools with regard to ICT. Before the introduction of computers into Schools B and C, principals had to involve every stakeholder in the school to convince them as to why computers were necessary in the schools. It was during these negotiations that parents demonstrated support for the principal and the schools' initiatives. During the interviews principals acknowledged being supported by parents. Principal C indicated that computer literate parents assisted him in explaining to other parents about the benefits of computers to learners and that it was worthwhile for them to pay the additional R400 per annum over and above what they were already paying as fees. Principal B also mentioned convening a parents' meeting when they had discussed the idea of introducing computers into the school and they accepted the idea without much resistance. Parents were not the only people marshalled for support: teachers, learners and the school board were also involved.

External agents have also influenced the schools negatively. According to Principal C, parents associated with School C were very reluctant to pay the computer levy. An increase of fees by R400.00 was too much for parents because of the many social problems in homes, among them the dying of breadwinners in families. The computer levy was divided into the four quarters, that is, R100.00 per quarter to make payments easier for parents. This, however, caused another problem, parents refused to pay for the fourth quarter, because it has the shortest teaching time due to the end of year examinations. The delayed and non-payments of the computer levy by parents within the school year affected financial planning and budgeting. Part of the levy was directed towards the purchase of a few computers for the school each year and this was affected by late payments.

The MoE was one external factor that impacted on the school negatively. School C was one of the pilot schools for the Computer Education curriculum: and at the end of 2005 had to sit candidates for the final year of secondary schooling (Form C) examination. According to Principal C, the examining body seemed ill-prepared for the examination: hence 72% of learners failed the examination (Nketekete, 2006:3) mainly due to the way the examinations were handled. In his study of the factors contributing to the poor performance in the Computer Education examination, Nketekete identified the way the examination was administered as one of the contributing factors to the poor performance (2006:7).

During the interview, Principal C also stated that the MoE has not been supportive to schools such as School C that initiated the introduction of computers:

*I felt that the computers that NEPAD was already giving out, could have been given to schools who [sic] had already shown interest in that: and we were one of those schools. ... We sacrificed and we got nothing: we got no motivation from the government. I don't think it will ultimately meet the expectations of even the government. ... I don't think the Ministry is supportive (line 345-358).*

According to Principal C, the Minister of Education was not informed that there were already schools in the country that have had computers for several years. At the launch of the NEPAD e-schools pilot phase the Minister of Education stated that “he was asking for computers from

donors, NEPAD: ... which were being brought to the very first schools (according to the Minister) who [sic] were going to start computer literacy" (Line 342-344).

Institutional, administrative, peer and collaborative support have been identified as the main support structures for all staff members, especially teachers in a school. Additionally, principals seem to be influenced by external stakeholders such as parents and the government.

## 5.6 Access

During data analysis, access emerged as one of the major factors influencing ICT implementation at the schools. Access here will be subdivided into two subheadings: Times of access and the quality of the access.

### 5.6.1 Times of access

Slightly different questions were posed to the participants on this issue, but all questions tried to establish whether there were specific times when computers could be used and the suitability of these times to the users at the schools. Principals were asked whether computers were available all the time for the different users. Principal A responded "yes" to the question and he explained further that the computer teacher is **always** (my emphasis) available to assist even after school hours because the computer teacher resides on campus. Principal B explained that there were some restrictions in terms of access because only certain classes have been granted access after school hours. Teachers from School B, on the other hand are generally not allowed to visit the computer lab after school hours except when given permission from the computer teachers. However, they are allowed to use the office computer at any time.

*You see, this office one the teachers can use **every time** (my emphasis) they want, but the ones students are using for the lessons they don't belong to the school so the teachers for the computer studies give permission to the teachers to use when they want, that's how it goes. ...When they want to do something after school hours they may not easily access it when those teachers are not there (Principal B, Line 76-86).*

In response to the question, Principal C explained that in addition to the available computers for teachers, teachers can use the computer laboratory **anytime** (my emphasis) after school hours.

Although principals did not explicitly state this, it has been implied in their statements that teachers and learners are allowed unlimited access to computers during school hours. In fact, most (62.5%) teachers in the three schools indicated that they have unlimited access to computers at their schools. This is an encouraging factor except that it has proved not to be totally without problems. Teacher 3, in School A mentioned that she does not have access to the computer every time she wants to use it because at times the time she has clashes with other classes. Access to the computer laboratory is restricted for teachers in School B because of the deprived arrangement between the computer company and the school.

Although principals have used phrases such as ‘anytime’, ‘always’ and ‘every time’ to indicate that access to computers is unlimited for teachers, if it is not scheduled as is the case in all the schools, there is bound to be problems. The problem of a lack of scheduled times of access for teachers may have led to the type of responses obtained from computer teachers on the issue.

In one question computer teachers were asked: ‘Do teachers have access to computers anytime they want to use them?’ All of them answered ‘Yes’ to this question. This is definitely an enabling factor. In the next question: ‘Do teachers have access to computers after school?’ only two computer teachers answered “yes” to the question: one from School A and another from School C. Two of the computer teachers, one from School B and one from School C have given a “no” response to this question. The responses are so varied even within one school. The three computer teachers in School C have given three different responses.

**Table 5. 16: Do teachers have access to computers after school? (Qu.7.4)**

	<b>Response</b>
<b>Computer Teacher 1</b>	YES. Access to computers & Internet is 24/7
<b>Computer Teacher 2</b>	No response
<b>Computer Teacher 3</b>	NO
<b>Computer Teacher 4</b>	No response
<b>Computer Teacher 5</b>	YES

The varying responses and no response that appears in answers to this question suggest that there are unresolved issues regarding access of computers after school hours, especially in School B

and School C. The use of the computer laboratory definitely impacts on the working hours of the computer teachers and it is not comfortable even for some of the computer teachers to talk about, which may be why they chose not to respond to the question. A lack of correlation of the responses to access times is repeated in a similar question posed to teachers to establish whether learners are allowed to use the computer laboratory after school hours. Teachers in School B and C have given varying responses. It is clear that the two schools definitely have some unresolved issues regarding use of the computer laboratory after school hours both by the teachers and learners.

Another observation is that access times for teachers at the schools are haphazard. In School C one observes that teachers can only access computers in the computer laboratory after classes *'except when students are using them'* (Principal C, Line 101). However, in School C teachers are better off because they have a few computers in the staffroom: they are not as desperate as teachers in School B for the computer laboratory.

I think computer access times have to fit in with school times for all concerned. The computer teachers as well as the other subject teachers have to work stipulated number of hours. Specific arrangements have to be made for access to the computer laboratory after school hours. What one realises is that computer use for teachers in the schools is an uncertain business; there are no stipulated times of access for teachers in the computer laboratory during school hours. There are insufficient computers in the staffrooms for teachers, which is why they have to use the computer laboratory.

### **5.6.2 Quality of Access**

Quality of access will be discussed briefly in terms of the adequacy of the hardware for the different users, that is, computer: user ratio, available software and Internet access. According to the principals, the staff and learners have an adequate number of computers. An elated comment was made by one of the principals:

*We have computers that can match the biggest stream ... so we have no problem with the number of computers* (Principal C, Line 72-79).

Other staff members in the same and the other two schools have expressed similar comments: that the number of computers at the schools was adequate. However, there is contradictory evidence which points to the fact that the number of computers for teachers is not adequate at all (Section: 5.2.3). There would not be any reason for teachers to use computers in the computer laboratory for their own administrative work if there were sufficient number of computers in the staffroom.

Another indicator for the inadequacy of access for teachers is the computer to user ratio. Computer to user ratios were calculated in an earlier section (Section: 5.2.3) and from that data one can deduce that on average, in the three schools, the computer: user ratios are as shown in Table 5.17. The highest ratio is the computer: teacher ratio: on average, 20 teachers have to share one computer at the schools. This is definitely not quality of access. Reference to quality of access and its measurement using the number of computers per persons has been documented by Pelgrum (2003).

**Table 5. 17 Average computer: user ratios in the three schools**

Computer: Administration staff Ratio	Computer: Teacher Ratio	Computer: Learners Ratio
1: 3	1: 20	1:2

Another measure of the quality of access is the presence of subject-related software and Internet access at a school to facilitate teaching and learning. Teachers have given reasons to show that they were not totally happy with the existing infrastructure.

*The fact that there is no Internet here: searching for information on the content, teaching methods, and lesson plans becomes very difficult (Teacher 7, School C).*

*No school policy on accessibility for use in teaching. No appropriate software for my subjects (Teacher 6, School C).*

Absence of the Internet and subject-related software has been mentioned by teachers in School B as inhibiting the use of computers for teaching and learning purposes. These teachers seem to be conversant with the potential of the Internet and subject-specific software to enhance their teaching, although their school is not equipped with such facilities.

## 5.7 Computer Use

This section has focussed more on teachers' use of computers although questions on computer use were posed to the other users as well. The section will be subdivided into two sections: Purpose of Use and Frequency of use. The 'purpose of use' section will highlight these four categories of teachers' use: Administration, Communication and Research, Teaching Preparation.

### 5.7.1 Purpose of Use

All respondents have been asked to respond to slightly different questions about how they use computers both at the school and at home. The figure below shows the teachers' responses to the question: Indicate how often you use the computer for the tasks indicated:

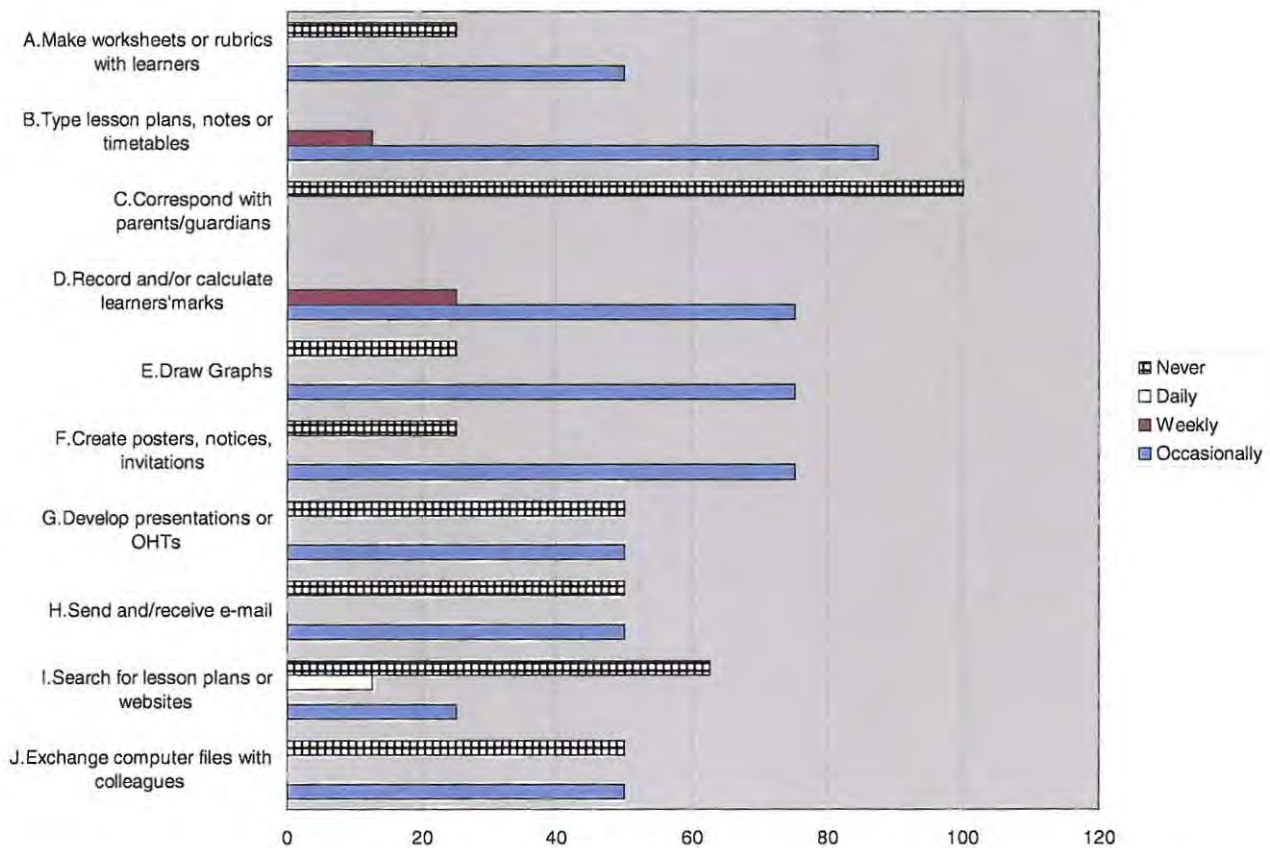


Figure 5. 2 Percentage of teachers using computers for different tasks

From the graph (Figure 5.2) it can be noticed that all tasks, except Task C, have been performed only occasionally by at least 50 percent of teachers. Majority of teachers (88%) use computers to type lesson plans, notes and timetables (Task B) only occasionally and 13% do the task more frequently, which is weekly. The next popular tasks are Task D, E and F which have been performed occasionally by 75% of the teachers. Task D also has some more frequent users: 13 % of teachers use computers weekly for Task D. Less (50%) teachers are using the computer for Tasks A, G, H and J on an occasional basis. Although Task I is not very popular, that is performed by 13% of teachers, it has the most frequent users who search for lesson plans and websites on a daily basis. This is not surprising from a teacher in School A as this school is the only school with Internet connectivity in this study.

From the graph it can be concluded that most teachers use the computer only occasionally for most of the tasks stated. There are few frequent users in a few of the tasks: weekly users (Task B and Task D) and daily users (Task I). It can be deduced that majority of teachers (88%) use the computer occasionally for preparation of lessons (Task B): they use the computer for typing lesson plans, notes and timetable. The next popular tasks are Tasks D, E and F which are administration tasks performed occasionally by 75% of teachers. The next group of tasks in decreasing popularity are Tasks A, G, H and J used occasionally by 50% of teachers.

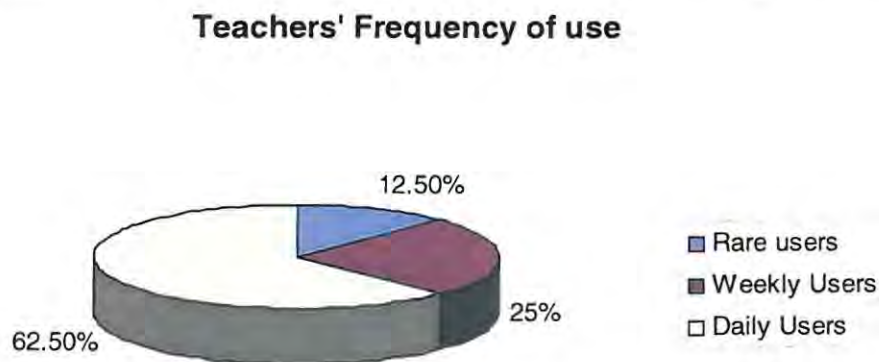
### **5.7.2 Frequency of use**

In the interviews with principals, they were asked how often they used the computer. Principal A stated that he used the computer on a daily basis. This was in agreement with how teachers in the same school classified him in response to the question: *'How would you classify your principal regarding the use of a computer?'* (Qu.6.7): the three teachers all classified him as a frequent user. Principal B in response to the same question stated that *'I'm not using it myself, but I ask the secretary to use it, we have two in the office here for office business'* (Line 8). The two teachers from the school also described him as a non-user. Although Principal C described himself as a non-user like Principal B, the teachers in the school differed in the way that they described him. Two of the teachers agreed with him and classified him as a non-user, but one of the teachers classified him as a 'seldom user'. During the interview with Principal C, he made it clear that he had his own computer in his office which he used for a short time and then it was taken to the computer laboratory when there was a shortage. The teacher that described him as a

'seldom user' may have seen him using the computer at one time; and he decided to opt for this classification for the principal.

Overall, 33% of the principals in the sample are frequent computer users while 66% of the principals do not use computers at all. Those who are not using the computers have acknowledged that their secretaries are doing all their work. Schiller has also found out that many principals in Australian schools do not see the need to develop ICT skills since they rely on other staff (2003:180). Principal B has described frequency of use of the computer by his secretary as '*the secretary in the office uses it when I ask her to*' (Line 6). And Principal C has described the frequency of use by the secretary as '*Almost everyday*' (Line 13).

When asked the same question computer teachers all responded that they were using computers daily for purposes of teaching learners (Qu.2.5). Teachers, on the other hand, differed in the way they responded to the question. Although they had indicated in the previous question: '*Do you have access to a computer at school?*'(Qu.4.1) that they all have access to a computer at school, when asked how often they used the computer their responses were as shown in Figure 4.3.



**Figure 5. 3: How often do you use computers at school?**

Figure 5.3 shows that a high percentage of teachers (62.2%) are daily computer users; followed by weekly computer users (25%) and then finally rare computer users (12.5%). These results are contradictory to the descriptions of the teachers as given by the principals. One criterion for selecting these teachers was that they should be frequent computer users; but the way they describe themselves is different. The principals' descriptions may have meant that these teachers

were better than the other teachers in terms of computer use. This means that to get a true picture of how frequently the teachers in a school used computers: one would need to study the entire teaching staff.

For principals we can conclude that the two principals in School B and School C are not using computers at all and Principal A uses computers frequently. And similarly, one can conclude that all the computer teachers in all the three schools are using computers daily. Daily use of computers by computer teachers is to be expected because that is basically their job and they have no other teaching subjects in the schools.

### 5.8 ICT Experience

Teachers' questionnaires were the only ones which included a question on experience in terms of the number of years the teachers had been using the computers. From the principals' interviews information was gathered about how long the school has had computers. A comparison was made of the length of time that schools had been using computers and teachers' experiences in order to establish whether the teachers' experience was obtained at the school or somewhere else (Table 5.18).

**Table 5. 18: Teachers' ICT experience in years**

	<1 year	1-2 years	3-4 years	5-6 years	7-10 years	10+	No. of years the school has had computers
Teacher 1 School A			1				1
Teacher 2 School A			1				
Teacher 3 School A			1				
Teacher 4 School B				1			4
Teacher 5 School B			*1				
Teacher 6 School C						1	4
Teacher 7 School C					1		
Teacher 8 School C					1		
<b>TOTALS</b>	0	0	4	1	2	1	
<b>PERCENTAGES</b>	0	0	50	12.5	25	12.5	

\* the only teacher with an experience matching number of years the school has had computers

Table 5.18 illustrates that 50% of the sampled teachers have a 3-4 years experience of using computers: 25% have experience of 7-10 years: 12.5% of the teachers have experience of 5-6 years and the last 12.5 percent have experience of 10 years or more. The majority (87.5%) of the teachers have experience greater than the number of years their schools have had computers

except Teacher 5. This may mean that they were already familiar with the equipment when it arrived in the school: hence they had more interest than the rest of the staff members (Scrimshaw, 2004). Three teachers, two in School A and one in School C have actually indicated that they were familiar with computers before their schools obtained computers. When asked 'What aspects of your training and past experience support or hinder your use of ICTs (Qu.3.4)?' The following responses were stated as supporting aspects:

*Having been exposed to the use of computers during my studies (Teacher 1, School A).*

*Self-teaching that I had when doing my masters (Teacher 3, School A).*

*I studied traditional computer programming (Teacher 6, School C).*

*I have worked with them (computers) for more than 10 years (Teacher 6, School C).*

## **5.9 Training**

Training in the three schools has been categorised into formal and informal strategies. The formal strategies can be described as once-off strategies, whereby principals, teachers, computer teachers or secretaries at the schools have attended a once-off training, large group training either at the school or outside the school. The informal strategies are characterised by being small group, one-on-one and continuing training. Different staff members in the three schools have undergone two or more of the training strategies. Table 5.19 illustrate the strategies that have been identified in the three schools for various staff members:

Table 5.19 illustrates only one of the three principals has received some form of training. Teachers have undergone more modes of training than the other staff members. The most common modes of training for teachers are computer literacy course at colleges and self-instruction at the schools. Computer teachers cited 'learning from colleagues' in two of the schools and this mode of training is only practiced by this group of staff. The common modes of training of secretaries at the schools are one-on-one coaching by computer teachers and self-instruction.

**Table 5. 19: Modes of ICT training at the three schools for different staff members**

Schools	Principals	Teachers	Computer teachers	Secretaries
A	<ul style="list-style-type: none"> <li>• A 2-3mth literacy course</li> <li>• A one-week ORACLE course</li> <li>• Self instruct on the job</li> </ul>	<ul style="list-style-type: none"> <li>• Part of college course</li> <li>• Formal literacy course</li> <li>• Self-instruct at work</li> <li>• Formal in-house training</li> <li>• One-on-one coaching</li> <li>• A one-week Oracle course</li> </ul>	<ul style="list-style-type: none"> <li>• Formal literacy course</li> <li>• Learning from colleagues</li> <li>• A one-week Oracle course</li> </ul>	<ul style="list-style-type: none"> <li>• One-on-one coaching by computer teacher when need arises</li> <li>• Self-instruct on the job</li> </ul>
B	<ul style="list-style-type: none"> <li>• No training</li> </ul>	<ul style="list-style-type: none"> <li>• Part of college course</li> <li>• Formal literacy course at college</li> <li>• Self-instruct at the job</li> </ul>	<ul style="list-style-type: none"> <li>• Learned from colleagues</li> </ul>	<ul style="list-style-type: none"> <li>• Formal literacy course</li> <li>• Self-instruct at job</li> </ul>
C	<ul style="list-style-type: none"> <li>• No training</li> </ul>	<ul style="list-style-type: none"> <li>• Part of college course</li> <li>• Formal literacy course</li> <li>• Self-instruct on job</li> <li>• One –on-one or small group coaching by computer teacher when need arises</li> </ul>	<ul style="list-style-type: none"> <li>• Self-instruct on the job</li> <li>• Formal literacy course</li> </ul>	<ul style="list-style-type: none"> <li>• Formal training workshops by computer company</li> <li>• One-on-one coaching by computer teacher</li> </ul>

### 5.9.1 Principals

Table 5.19 illustrates that one of the three principals obtained some form of computer training. The mode of training has been formal training at a local computer company which has a training section: and usually it provides training for government and private sector employees as well as individuals. When he underwent the training, Principal A was then employed in a government sector. This principal has also had a one-week formal training as well as self- instruction on the job while he was a teacher at the school in 2005. At the beginning of 2006 he became a principal and he is a daily computer user as described by his teachers and himself. The other two principals have had no training and are not using computers.

### **5.9.2 Computer teachers**

Computer teachers in Schools A and C have had some formal computer training at a school and also self- instruction on the job. The Computer teacher in School A did not indicate formal training. he has learned using computers from colleagues only.

### **5.9.3 Secretaries**

According to Principal B. the secretary in School B has had formal computer literacy training because that was one of the requirements when she was hired. The secretary does not only perform clerical work. but she is also the school's accountant. She is the only one of the three secretaries with some formal training. The secretary in School C has attended two workshops organized by the computer company that is in partnership with the school. At School A an arrangement for a one-to-one coaching by the computer teacher has been made. This is similar to the arrangement at School A for the secretary: except that at this school the computer teacher emphasized that the secretary calls him when she needs assistance.

### **5.9.4 Teachers**

Of all the staff members. teachers have undergone more training modes than the other groups. Teachers from Schools A and C have had formal computer literacy training and acquired computer skills as part of main course while studying at colleges or universities: this could be classified as some form of external. pre-service training. Teachers in School A have also had a one-week course offered by NEPAD as preparation for using the ICT equipment and software provided by the NEPAD e-School project. Teachers were provided with training manuals as guides to complete the training for the rest of the teaching staff: some train-the-trainer education.

There has been school-based training for teachers at Schools A and C as well. Teachers who attended the NEPAD training at School A formed an ICT committee at the school. and together with the principal and computer teacher planned ways of training the rest of the teaching staff. Whole group workshops or formal in-house training sessions were organized: and these were followed by one-on-one coaching of teachers. In School C. the training strategy is basically a combination of informal small groups training by the computer teacher and self- instruction on the job. Self- instruction at work has been mentioned by teachers in School A as well.

It is interesting to realize that at least some form of training is occurring in the schools for all staff members to ensure effective implementation of ICTs. Principals A and C seem to acknowledge that teachers need to be trained in some computer skills: they take part in the planning of staff training, but Principal C does not take part in the actual training sessions. All principals are aware that training of teachers has to be continuing in order to update, refresh or improve acquired knowledge and skills of teachers. In addition, Principal C is enforcing the acquisition of some basic computer competence by all teachers so that they can perform some administrative work for themselves. All teachers in the school have to at least type exam questions, save the question items, record and save learners' marks. These activities were carried out by the administration secretary and she has been instructed to deny teachers that service.

In School B, there is no organized training for teachers, but the principal has stated that a few teachers have voluntarily visited the computer laboratory to "*make themselves [sic] computer literate. They want some awareness*" (Principal B, line 162-163). When asked why there is no subject-related software in the school so that learners do something related to their subject, Principal B raised an important point:

*Like I said we started in a small way; we are going to increase that in the coming year so that teachers also can do their work easily with the computers. ... We are yet to go that level of development* (Line 60, 68-70).

Principal B is aware that ICT implementation has to be done in stages. The school has started with use of computers for the administration and computer literacy of learners. Teacher use for administration purposes will follow and then integration into the curriculum. This implies stages of technological infusion. This is the opposite of what is happening in School A: School A is implementing several ideas at one go. Learners are attending a computer literacy course and at the same time they are using computers in learning their subjects. Teachers are learning computer skills and expected to be integrating ICTs into the curriculum. Concurrently, teacher training in the two areas: professional competence with ICT and Integrating ICT within the curriculum.

It is evident from Table 5.19 that some modes of training are more popular with teachers, than others. Table 5.19 has organized the training modes from the most popular to the least popular from the teachers' responses to Question 3.1 of their questionnaire. Self-teaching on the job is the most popular training mode with teachers. Fewer teachers (50%) have learned to use computers as part of their studies at colleges or as a formal college course. In-house training and external in-service courses are the least popular modes of training for teachers in the sampled schools.

**Table 5. 20: Popularity of teacher training modes**

<b>Training Mode</b>	<b>Percentage of teachers</b>
Self teaching on the job	62.5
Part of main course at college	50
Formal college course	50
In-house training	37.5
External in-service courses	25

Self-teaching on the job is a popular mode of training, not only for teachers: computer teachers and secretaries use this mode. The reason maybe that it works for them: one can carry it out at one's pace and just in time. From the teachers' responses it was also identified that teachers were employing, on the average, at least two training strategies. Some teachers in School A and C have been exposed to three strategies to develop themselves professionally.

From the discussion of teacher training strategies above a range of possibilities have surfaced: informal to formal: teacher-directed to government-directed: school-based to externally-based: one-to-one to one-to-group and voluntary to compulsory. A school can use a combination of the strategies that best suit the circumstances at the school.

Schools A and C have an in-house training plan for teachers. In School A the in-house training is run by teachers who have been trained externally by Oracle trainers as part of the NEPAD training plan. In School C the training is informal, performed by the computer teachers during or after school hours and based on the needs of the teachers. Although not written in a school ICT policy, teachers in this school are obligated to have set minimum computer skills for their own administration work and therefore, there is some pressure on teachers to acquire ICT skills. In

School B no training plan for teachers is available as yet. The principal is expecting teachers to use computers to acquire basic computer skills voluntarily. Principal B also expressed the view that as yet there is no expectation from teachers to use computers in subject areas and hence no subject-related software has been acquired for the school as yet.

### **5.10 Teachers' Attitudes**

During the interviews, principals referred to teachers' attitudes as one of the challenges they were facing in the implementation of ICTs. One or two computer teachers also referred to teachers' attitudes as preventing them from using computers. In response to the open-ended questions where they were asked to state enabling or constraining factors in the implementation of ICTs, some teachers mentioned other teachers' attitudes. Teachers' attitudes that seem to enable ICT implementation are: They are happy about the presence of computers in the schools despite the small quantities for teachers; and they have been described as having a positive attitude towards the integration of ICTs into the curriculum. However, several teachers have been described to demonstrate several attitudes that hinder the ICT implementation process. These attitudes are: Lack of passion, lack of interest, fear of asking for help, anxiety over the new technologies, tendency to focus on non-academic aspects of ICTs and resistance to change.

The discussion in this chapter has illustrated that there are a myriad of factors influencing the process of ICT implementation. Majority of these factors have appeared in the literature, only a few of these, such the direct involvement of private IT companies in schools have not been identified in the literature: hence this may be peculiar to the context of this study. A detailed summary of the findings will be presented in chapter 6: classifying the issues highlighted in this chapter according to their impact on principal leadership, teacher professional development and resource provision during ICT implementation.

## **Chapter 6: Conclusions and recommendations**

### **6.1 Introduction**

This chapter presents a summary of findings and conclusions drawn from the study. It proposes recommendations for action and areas for further investigation to improve ICT implementation in secondary schools in Lesotho, and maybe other larger ICT in education projects in Africa. In conclusion, the chapter highlights lessons learned in the whole process of researching and writing up the thesis and assigns value to the study.

The goals of the research were to:

- Understand the enabling and constraining factors in the implementation of ICTs in Lesotho secondary schools.
- Use the findings from the case studies to suggest ways in which schools could learn from each other's ICT implementation as well as to inform the countrywide roll-out of the NEPAD project.
- Inform the MoE in order for them to develop suitable in-service training for teachers on the basis of the identified constraints and enablers of ICT from the case studies.

The goals were translated into the following main question: What are the key enabling and constraining factors in the implementation of ICTs in secondary schools in Lesotho? In order to address the main question, the following subsidiary questions were formulated:

- What role does principal leadership play in enabling or constraining the implementation of ICTs in secondary schools?
- What role does teacher professional development play in enabling or constraining the implementation of ICTs in secondary schools?
- What role does resource provision play in enabling or constraining the implementation of ICTs in secondary schools?

### **6.2 Summary of findings**

This section presents a summary of findings established with respect to the purpose, objectives and the main research questions that guided the study. The findings have been categorised into

the main themes of the investigation: principal leadership, teacher professional development and resources and related to insights from the literature. In each theme, the identified constraining and enabling factors are depicted.

### **6.2.1 Principal Leadership**

It has been established in this study that the major factors that support or hinder principal leadership in the implementation of ICTs in schools include: prior planning; available resources; access and use; support and training.

#### **Planning**

No prior school-level planning before implementation was evident in all schools apart from the convening of meetings of different stakeholders: the school board, parents and teachers to convince them of the benefits of computers to learners. There were no minutes available for the proceedings so the researcher is not party to the benefits that were conveyed to the meetings' participants. The only major preparation was the refurbishment of rooms to accommodate the computers, either by converting existing rooms into computer laboratories or erecting new buildings.

Implementation commenced with the placement of ICT infrastructure in the schools. There seemed to be no organisational planning in terms of clear vision, school policies, budgeting or teacher training to guide use of the ICT equipment by teachers and learners. Principals seem to have some kind of unwritten vision, which has not yet been communicated to other staff members and so there is no collective understanding and commitment to ICT implementation. Hawkrige *et al.* (1990) and Bialobrzeska & Cohen (2005) have established that for ICT implementation to take off there should be clear national and school ICT policies to inform strategic planning and use. Proper ICT implementation planning seems to be impeded by lack of ministry level and school level policies in addition to uninformed principals.

Unsatisfactory partnerships between the computer companies and the schools have occurred and have impeded the smooth school level ICT implementation. Principals have relied on external advice in decision making on such issues as the purchase of appropriate ICT equipment for the schools. This may lead to computer companies directing decisions to suit their own interests and not particularly the schools' interests. In developed countries such as the UK and USA,

partnerships have been established between the government and IT industry. These partnerships are responsible for decisions on ICT equipment and other related matters for the benefit of the schools. Agreements are not made at school level like in some Lesotho schools. Government level partnerships may have the advantage of ensuring uniformity of ICT equipment, training and use in schools. The government may also have expertise in the field of ICT in education for advice and not rely on inexperienced peers and over eager salespersons as has been identified as one of the challenges of principals in the literature.

Although, it has been discovered that it is the expectation of some principals that computers be included in the curriculum, there are no strategic plans in the school as to how integration into the curriculum should be performed. Principals have also expressed the view that teachers are allowed unlimited access to computers, but the shortage of teachers' computers necessitates access times to be scheduled to allow teachers to use the computer laboratory equipment as well. Selwyn (1999) has ascertained that lack of resources for teachers hinders classroom ICT implementation. This problem is compounded by the lack of shared school level vision and policies to direct curriculum integration.

### **Resources**

It has been revealed in this study that the acquisition of computers by schools has been achieved through hiring, donations or small purchases by schools over a number of years. Hiring involved an unwritten agreement between private IT companies and the schools for a stipulated number of years. The involvement of private companies in obtaining ICT equipment for the schools has an advantage of ensuring the acquisition of large quantities of learners' computers at the same time, convenient software maintenance and upgrading, which would be expensive for the schools. It has been established in the literature that purchases and maintenance of IT equipment for schools in developed countries is performed by the government through private companies and it is budgeted for annually.

The donation of ICT equipment, curriculum, and teacher training material by the government through NEPAD, and working with private companies, has enabled the initial and expensive stage of the implementation process. Through the assistance of private companies schools have also been able to buy computers in small, affordable quantities for a number of years as well as inheriting the hired ICT equipment at the end of the contracts. Although these may seem to be

convenient working arrangements for the schools. they are associated with certain constraints on principal leadership: the ICT equipment may not match the purpose for which it is intended or pose challenges on maintenance and upgrading.

The ICT equipment donated to the schools has been found to be more sophisticated and not very useful for the purposes for which they are intended. If the principal was ICT informed and had been involved. he could have made better decisions with regard to ICT infrastructure for the schools. The 'inherited' computers can be obsolete and useless by the time they are donated to the school. This also requires an informed or technical advice for the administration of the school. Buying computers in affordable batches for a number of years may also pose a problem in setting up and maintaining the software in the computer laboratory.

### **Access and Use**

The administration office in each of the schools has at least one computer. The principal in the NEPAD- sponsored school (Principal A) also has a personal computer, printer and scanner in his office. In the other two schools, the one computer has to be shared between the principal, deputy principal (s) and the secretary. In terms of access, Principal A has better access compared to the other two principals and it follows that he was found to be the only one using computers on a daily basis: both for administration and teaching purposes. Because of his regular use of the ICT equipment he was able to give an opinion about the relevance of the digital content provided to supplement the school curriculum. This has placed him in a better position to facilitate ICT committees and other ICT-related meetings because he is comparatively better informed than the other two principals. It has been established in the literature that a school leader that collaborates with teachers and strong teacher support networks operating within schools encouraged successful implementation.

The other two principals have less access to the administration office computer because there is only one computer and the secretary uses it most times during school hours as principals have indicated. It follows that they are not regular computer users and they are disadvantaged with regard to exercising their facilitative role in ICT related meetings. Possession of a computer at home would assist the principals in acquiring computer skills and at least raising their confidence levels. but they all have no computers at home. Developed countries such as the UK, USA and Australia have addressed this problem by providing laptops for principals either at subsidised

prices or free of charge. In return, the government through the Ministries of Education enforces policies pertaining to the use of computers for professional communication with local or regional education departments (Kearns, 2002).

### **Training**

Principal A is the only one principal who has undergone ICT training and has adequate experience of using computers. The type of ICT training for the principal has been external, once-off and in-house continuing training. The external training of Principal A was planned and organised by his employers in his previous job and by the Ministry of Education through NEPAD in his present job. The other two principals, B and C, have never received any form of training. Principal C has at least been involved in organising some form of training for teachers and the secretary.

There are no training plans for staff in School B: a few interested teachers at the school voluntarily employ self-instruction to acquire computer skills. Principals have acknowledged the necessity to have continuing ICT professional development of staff and as such have organised and planned training for staff, especially teachers. The school-based ICT training for teachers in School C has been compulsory to meet certain targeted skills for administrative uses of teachers. Additionally, teachers consult the computer teachers to address individual or group ICT needs. In School A, training has taken the form of whole staff training workshops at the school following the external training of a few teachers by NEPAD. Additionally, one-on-one coaching to address individual needs of teachers and some administrative staff is performed at school-level.

### **Support**

Two main external kinds of support that have influenced principals have been established in this study. Parents have supported principals in the decision to introduce computers into the schools although during the implementation process some parents demonstrated their opposition to pay the computer levy. Principals seem to be affected negatively by parents and the Ministry of Education in their administrative role as the chief accounting officer and the chief invigilator in the external examinations respectively. Parents have shown reluctance to pay the computer levy which was decided upon in a parents' meeting and this affected budgeting for the purchase of computers in School C. The poor planning and organisation of the external Computer Education

examination affected the smooth running of the examination at school-level and hence many learners failed the examination in School C.

According to Principal C, schools that had initiated ICT implementation were not happy about the government's selection of schools for the NEPAD project. The initiators felt that as a way to motivate and support them, the government could have selected one of the schools that had already shown interest in ICTs. The literature discussed earlier has confirmed that principals who were initiators rather than responders to the ICT in schools change were more likely to lead their teachers to successful ICT use in their classrooms (Schiller, 2002).

### **6.2.2 Teacher Professional Development**

There are several factors that either enable or impede teachers in the use of ICTs in their administration, research, communication or teaching roles. However, the discussion will be organised into headings similar to the ones used for principal leadership for consistency, that is, planning, resources, access & use, training and support. The four categories of uses will be incorporated in the access and use section.

#### **Planning**

Prior to installing computers, some schools' rooms had to be made available to house the computers. Different subject rooms were converted into computer laboratories. In School A, one classroom and a library were converted into the computer laboratory and media centre respectively. In School B, one of the science laboratories was changed to a computer laboratory. A technology teacher in School A became a computer teacher. There was no question in this study to find out how this had affected the subject teachers involved in the changes, but it is possible that this could have caused some timetable disruptions if the rooms had been allocated to some other uses or learners. It may have been worse for School A because the computers were brought to the school in the middle of the school year.

Several times teachers have referred to the absence of a policy on access and ICT integration into the curriculum as constraining their ICT implementation in the classroom. So a lack of policies does not only affect principal leadership, it also affects teachers' professional work. In fact,

Kennewell *et al* (2000) has alluded to the fact that lack of clarity of educational objectives for ICT in schools has led to many failures in the UK.

### **Available Resources**

It has been established that teachers are satisfied with the mere availability of computers in the schools, without much consideration of other factors such as accessibility. In School B, where there are no computers in the staffroom and teachers have to find time between their lessons to use the computers in the laboratory, teachers stated repeatedly that the presence of computers in the school was an enabling factor for ICT implementation. They never mentioned having no computers in the staffroom and problems of access of computer laboratory computers.

Surprisingly, in the schools where there were few computers in the staffroom, teachers stated that the absence of a policy on access was impeding their use of ICTs in teaching. This could mean that teachers were not satisfied with the number of computers allocated to them. There was also dissatisfaction with the absence of subject-related software and Internet in the two schools, B and C, where there were a few computers for teachers' use.

The provision of guiding manuals and a variety of generic and subject-related software for teachers in School A seems to encourage classroom implementation which is more evident in School A than in the other schools. It has been established in the literature that in developed countries guidance is provided for schools to achieve the demanding ICT curriculum. In the UK the guidance stresses the need to have a school ICT policy and plan for its implementation.

Fifty percent of the sampled teachers had computers at home and 75% of them were using their computers for teaching preparations and other administrative work.

### **Access and Use**

Location of the computers, the times when teachers can access the computers and the amount of time allocated for access affects personal use and classroom use of ICTs by teachers. In all the schools, there is more than one place where teachers can access computers. The administration office, which is the only other place where teachers in School B can access computers, seems to deter teachers from using them. The other places where teachers seem to access computers at the schools is the staffroom for acquisition of computer skills and for administration work: the

computer laboratory and media centre for teaching purposes. The computer laboratory has also been used for the training of teachers.

Suitable times of access to computers in the computer laboratory in all schools by teachers for teaching and other purposes seems to be after school hours when the computer laboratory is not being used by the computer teacher(s). There is no scheduled time for access of the computer laboratory by teachers. If there is a need to use computers during school hours, teachers have to make special arrangements with the computer teacher to use the computer laboratory. In addition to these difficulties in access arrangements for teaching purposes, teachers in School B do not have the freedom to use the computer laboratory even after school hours because of the school-computer company partnership which is not working well.

Although the total time that teachers can gain access to computers has been described as ample by principals and computer teachers, it is not scheduled, and it has been seen to be problematic by teachers, especially for teaching-related use. This problem can be attributed to lack of policies on access in the schools.

The majority of teachers use computers only occasionally for a variety of tasks. This means that the available software at the schools can allow performance of a variety of tasks. What is of concern is the frequency of performing these tasks. The majority of the tasks are carried out only occasionally. Typing lesson plans, notes and timetables being the most popular tasks. The type of access arrangements discussed above may be contributing to this low frequency of use. Searching for lesson plans or other websites on the Internet have been indicated to be undertaken more frequently than the rest of the tasks; these tasks are performed daily by at least a few teachers. Recording and/calculating learners' marks as well as typing lesson plans, notes and timetables are performed weekly, therefore these administrative tasks are second to Internet use in terms of frequency of use.

According to the ANR report (2003), in Australia, all schools seemed to manage better initiatives to improve administrative processes through the use of ICTs both at school and state levels other than other initiatives. The literature has also alluded to the fact that ICTs are used more frequently for professional development, personal use and administrative purposes than teaching and learning purposes.

## **Training**

Training plans for teachers commenced when the ICT equipment was already available in the schools. In School A, training of teachers occurred one week before computers were distributed to the schools. The small time interval between the training and use could have assisted teachers in that before they forgot what they had been trained to do, they could use the computers in the school. If a lot of time had elapsed between the time of training and use and training of other teachers this may have not been as effective. The training plan for teachers in School C occurred when the computers were already installed at the school.

The majority of the sampled teachers have had some exposure to some computer skills training in institutions of higher learning. In addition, they have on average, experiences of computer use greater than the number of years their respective schools have had computers. This means that they gained this experience before the schools obtained computers. Familiarity with the equipment and interest seem to be contributing to the increased use of computers. As the teachers become familiar with the technologies their needs and expectations change and this will hopefully lead to teachers moving to the next stage of ICT implementation (Tearle, 2004).

The training strategies used in the schools vary from attending external courses, attending in-school courses, learning via the computer teacher and learning via teachers that replicate what they learned in external courses and self-instruction. These learning modes are similar to what Pelgrum (2003) identified as the most popular training modes for in-servicing of teachers in the SITES-M1 study. But the teachers in the three Lesotho schools seem to possess only basic computer skills compared to the rest of the teaching staff and no pedagogical competencies related to ICT as some of the teachers have indicated in their responses. Nketekete (2006) has also confirmed that in-service training and assistance on ways to teach the subject was lacking for teachers to successfully implement ICTs in the classrooms.

## **Support**

Various support structures for teachers are in place at the schools: Institutional and administrative, peer, collaborative and technical support. Administrative and institutional support is more evident in School A and School C where teachers are provided with computers in the staffroom for easy access. Additionally, teachers in School A have some guiding manual for

teaching purposes and they have mentioned the principal supporting them. although there was no explanation as to how the principal supports them. Since the principal in this school has been trained with some of the teachers by Oracle. he has been collaborating with teachers in planning the training of other teachers as well as facilitating some ICT-related meetings. This type of collaboration with teachers has been identified by Scrimshaw (2004) as one principal role that encourages teachers to adopt the innovation.

Teachers also seem to be contented with peer and technical support that they receive from other teachers and the computer teacher: and these have been alluded to several times as enabling factors. Specifically, the two schools that have agreements with private companies have efficient technical support but the NEPAD school's technical support has been met with challenges because of the support that is not local and takes a long time to reach the school. Insufficient and lack of technical support has been ascertained in the literature as one hindrance to classroom implementation (Dawes 1999; Selwyn. 1999).

### **Attitudes**

Teachers' attitudes to the new technologies have been cited, mainly by principals, as impeding their use of ICTs. Teachers have been described as displaying the following negative attitudes: Lack of interest and passion, anxiety over new technologies, resistance to change, and fear of asking for help. Similar teacher attitudes have been identified in the literature as barriers to integration of ICTs into the curriculum. On the contrary, teachers in this study expressed their eagerness to use the technology in their teaching, but felt discouraged from doing so by lack of clear policies in the school. The eagerness of learners to learn and their increased attentiveness when they are in the computer laboratory has been mentioned by some teachers as a reason that encourages them to use the technologies in teaching in School A. The negative attitudes displayed by teachers towards the new technologies may be attributed to the lack of policies that direct access and use as well as the lack of training and support on ICT- related pedagogies.

### **6.2.3 Resources**

Quantity and quality of the resources seem to impede the use of the technologies to a lesser extent than other resource-related issues such as access arrangements, reliability of the resources and suitability of the resources for use.

#### **Quantity and quality**

The presence of an adequate number of computers has been mentioned several times as an enabling factor by teachers, more so by teachers in School B where there is the least number of computers for teachers. In fact, teachers never mentioned inadequate number of computers for themselves. It has been inferred from some of their statements that the quantity of computers was not adequate. Statements related to using the computer laboratory computers in the schools where there is provision of computers for teachers were indicative of an inadequate number of teacher computers. It has been confirmed by the literature that inadequate ICT resources for teachers impede classroom implementation. However, principals and computer teachers' responses in this study seem to indicate satisfaction with the quantity and quality of the technologies. Some inadequacies of printers, scanners and subject-related software were mentioned by teachers.

Internet connectivity has also been stated as both an enabler and constraint in School A. The Internet has been referred to as saving preparation time and providing a lot of useful information, therefore an enabler. But the information from the internet has also been described as not user-friendly. For schools without the Internet, absence of the Internet has been stated repeatedly as a constraint in teaching with ICTs. Lack or limited internet connection has been referred to in the literature as a barrier to the integration of ICTs into the curriculum by Brinkerhoff and Bowdoin (2006).

#### **Access Arrangements**

Location of the computers in the schools has been found to be either an enabling or constraining factor. If placed in places where users can easily access them, as is the case in School A and C, finding a computer to use is not an effort and therefore there is the likelihood that frequency of use can be increased. However, if teachers have to walk some distance to the administration building to use a computer like in School B, then there is the possibility of less use of computers.

The literature has suggested that principals deploy computers in high use, easy access areas such as classrooms to encourage implementation. However, this may not be feasible in developing countries because the main focus presently is the acquisition of the technologies and not access arrangements per se. Although placing computers in several places can be advantageous for users, it can also prove to be a security threat.

### **Reliability of the resources**

For computers to work well there must be reliable technical support in place, so that teachers and other users do not have to wait a long time for computers to start working again after a technical problem has occurred. This can have a negative effect on the motivation levels of users. In Schools B and C technical support seems to be working well. The technical support is local, and can be called whenever there is some technical failure. In School A, however, delays of technical assistance have been reported by the computer teacher and principal because the technician resides outside the country.

### **6.2.4 Developmental Stages in the use of ICT in teaching and learning**

The sampled schools seem to be at the first stage of technological infusion according to Van Melle *et al.*'s model (2003). The schools have displayed mainly the characteristics in the 'Exploring the uses of ICT' stage of the model, which is the first stage of the model. A few characteristics of the second stage are evident. The characteristics of the schools that have been identified from this study and match those found in Van Melle *et al.*'s model are as follows:

- Computer technology initiatives are independent and isolated (stage 1):
- Primary use of technology occurs in self-contained computer laboratories (stage 1):
- Professional development activities focus on skill development (stage 1):
- Planning is focused on getting sufficient funding for immediate initiatives (stage 1):
- Computer initiatives are focused on individual efforts (stage 1):
- Computer technology initiatives are focused on skill building and in the use of instructional and productivity software or hardware (stage 2)
- Computer technology initiatives are clearly linked to student needs and systemic development (stage 2):

- Use of computer technology occurs in a variety of settings and activities (stage 2) (2003: 278).

All the studied schools display stage one characteristics as stated above. School A, however, seems to be forging a bit ahead of the other two schools, and some stage two characteristics have been identified in School A.

### **6.3 Conclusion**

The aim of the study has been to contribute towards understanding enabling and constraining factors in ICT implementation in Lesotho secondary schools. The focus was the role of principal leadership, teacher professional development and resources in the implementation process. The findings have revealed that principals as leaders in the ICT implementation process have to reconsider planning and focus on access and use of the technologies, training, support and management of the resources. ICT in schools involves educational change and as such requires a leader who can lead the change: providing the vision and objectives, as well as professional development initiatives in using ICT to bring about pedagogical changes.

The study has illuminated a variety of factors that impede principals from performing their technology leadership role. The principals' role of planning for ICT adoption in the school is impeded to a large extent by their lack of training and being inadequately informed about the technologies. The same reasons seem to explain the non-use of the technologies by principals and their reluctance to acquire computers for themselves. The vision and understanding of senior managers in schools are crucial in setting a context in which ICT can flourish (Schiller, 2003). The MoE and other support agents for principals have to assist the principal as technology leaders by providing appropriate training and support. I think that principals that have initiated the introduction of computers in their schools could be provided with their own dedicated computers, perhaps a laptop, to encourage communication with the MoE.

From the literature, I discerned that the ultimate goal of ICTs in schools is the integration of the technologies into the curriculum. The climax of ICT integration into the curriculum is when teachers can make decisions about when to, or not to, or how to use the ICT resources in teaching particular subjects (UNESCO, 2002). Principals in this study have declared their

intention to integrate ICTs into the curriculum but this can only be achieved through properly planned teacher professional development strategies which are lacking at the moment.

According to findings in this study teachers are hindered from integrating ICTs into the curriculum because of the lack of strategic planning, training and support rather than insufficient resources. Prior use, familiarity with ICTs and training has stimulated teachers' interest in use of the technologies. A variety of support strategies: technical, peer, collaborative and administrative support also seem to enable classroom implementation. It has been ascertained that the main uses of ICTs in the case study schools by teachers are administration work and research on teaching and learning related websites from the Internet. It will take additional, more intensive training and support of teachers to build enough confidence for them to venture into classroom implementation. It would be helpful for school leaders and the MoE to be aware of these factors and prepare teacher professional development accordingly.

It has been ascertained in this study that resource-related factors enabling or constraining the implementation process are not only linked to quantity and quality of the technologies. These were found to be the main influencing factors in developed countries in the earlier years of ICT implementation in schools (Tearle, 2004). Rather, the factors impeding or facilitating the process in this study are related mainly to access arrangements and reliability of the resources: similar to some of the more recent resource-related concerns in developed countries. To ensure reliability of the resources and efficient access arrangements requires proper strategic planning at the school level. This again impinges on the role of the MoE in training and supporting the school principal. It has been established in this study that only a few teachers utilize the ICT equipment at the schools. It therefore follows that teachers, unlike me, would perceive the ICT equipment at their schools to be adequate because the demand for computer use is still low. My perception is based on the overall teacher: computer ratio.

## **6.4 Recommendations**

It has become apparent throughout this study that lessons have been learnt and useful insights gained that could guide present and future implementation of ICT in education projects and processes. The recommendations presented relate to the specific findings of the study and

literature and are directed specifically to principals as representatives of schools and the Ministry of Education.

### **6.4.1 The Principal**

#### *Planning*

- If a school chooses to use a computer company to hire learners' computers, it is advisable to arrange a formal partnership with the company, so that they agree on what the company and the schools' responsibilities will be before placement of the ICT equipment in schools. A written agreement is a better option as none of the agreements in the schools were documented.
- As schools plan ICT implementation it would be useful to include in their plans reliable and local technical support arrangements with the companies concerned as this has a potential to frustrate schools if not properly put in place from the beginning.

#### *Access and Use*

- It is advisable for subject-related ICT lessons to be included on the timetable if teachers are to apply ICT skills into subjects as intended. Time should also be provided for teachers' professional tasks if ICT implementation is to be a priority in a school.
- For teachers to be subject leaders, they have to be competent and confident in the subject first. Lack of confidence in the ICT subject may have led to the many negative teacher attitudes that have surfaced in this study. It is recommended that for any ICT school project provision should be made for a highly motivated and dedicated ICT teacher, who should be adequately trained in pedagogical, as well as technical skills, to train learners and other teachers on the staff.

#### *Resources*

- Although purchasing computers incrementally over the years may be a financially convenient method of acquiring computers, it can pose problems of setting up the computer laboratory. It is advisable to buy a set of computers with the same specifications and quality for ease of networking, maintenance and updating in a computer laboratory

### *Training and support*

- Most participants in the study have had some initial training and have explored on their own the use of computers for a few years and therefore are familiar with the technology. This study recommends that teachers are supported with initial local face- to- face training and then provide adequate access for experimentation with the technology.
- Administration and research uses seem to be more popular with teachers. Training sessions should therefore initially focus on these activities before the introduction of classroom use because they may be quite appealing to teachers. Additionally, the benefits of these activities can give immediate gratification to teachers and encourage teacher use, whereas benefits of classroom use can be realised after several years.

### **6.4.2 Ministry of Education**

In order to accomplish effective ICT implementation in schools, it is crucial that the MoE considers the following:

- It is the responsibility of the MOE to identify experts in the field of Computer Science and ICT in education to extend the work that has already been accomplished by Oracle in providing electronic curriculum-related resources for teachers in the NEPAD School because teachers have found the software useful in many respects.
- Leaders often assume that teacher support for innovations will always be forthcoming just because they themselves are convinced of the value of the innovation. To convince teachers of the usefulness of ICTs in teaching and learning requires more extensive exploration of the technologies for some time and acquiring information on and experimenting with how they can be used in the classrooms. This exploration requires teachers to have frequent access to computers which could be achieved if at the present Education Resource Centres teachers are provided with computers. Additional Centres can be built to cover the remaining districts and remote schools.
- Training of principals should be at the forefront of ICT implementation so that principals can lead teachers in the implementation process, as it has been illustrated by Schiller (2003) that principals who were initiators, rather than managers or responders are more likely to lead their teachers to successful use of ICT in the day-to-day activities of

classrooms. School principals educated about the role of ICT in education are more likely to motivate teachers.

- A small number of principals who have initiated the introduction of computers into their schools can be given incentives by the Ministry by providing them with laptops and intensive training to ensure acquisition of ICT skills and knowledge of the usefulness of the technologies. Additionally, the MoE would benefit by communicating more easily with the principals and providing information on latest education developments, if they are provided with some form of Internet connectivity.
- In the MoE ICT training plan there should be a section on technical support for teachers and learners so that implementation runs effortlessly, with minimal technical hassles. In addition, strong Ministry support and guidance on the process is essential in the initial stages of the process.
- It is recommended that all persons intending to become teachers should be provided with a pre-service ICT education training in universities and colleges before they are certified as professional educators. Teachers will be more skilled and confident in a pre-service training environment and this will be less expensive than when they are in service.
- There is a tendency to use persons not qualified as teachers to teach computer literacy to learners and this is likely to be imitated in teacher training. Care must be taken when recruiting teacher trainers for in-service training, as non-educationists would not necessarily be conversant with teachers' roles and ICT-related pedagogic skills. These trainers might focus training on hardware and software functions, thus missing the pedagogic perspective.
- Developed countries have overcome the cost barrier of ICT to some extent by going into partnerships with the IT industry and have privatized training of teachers, monitoring and evaluation of the ICT implementation process (Kearns, 2002). It is recommended that the Ministry considers the feasibility of this option in Lesotho at the policy-making stage of ICT in education before a wide coverage of the schools.
- School preparedness for the new technologies is worth considering before the supply of the equipment to the schools or alternatively the ICT implementation process should be performed in stages. If a school is struggling academically or with the acquisition of basic resources will it cope with the maintenance and updating of newer technologies?

- SchoolNet Lesotho and NEPAD already possess missions and strategies for teachers to integrate ICTs into the curriculum. It would be helpful for the MoE to ask for assistance from persons in these ICT initiatives in the development of the ICT in education policy.

## **6.5 Limitations of the study**

Various aspects of the study could have influenced the type of findings. The research methodology and the scope of the research are the major limiting factors in this study.

The first limitation of this study was the relatively small sample size which may limit getting a bigger picture of the issues that have emerged. I am aware that more data could have been generated through interviews with the computer teachers since they are the most knowledgeable of all the participants on the ICT implementation issue. Such data could have probably resulted in further insights and a deeper analysis of the study. However, given the scope of the study, I was careful not to fall into a data 'overload' and so limited data collected by interviews to the three principals only. The type of data analysis and synthesis used in this study would have rendered a large sample size impossible or undesirable.

Another sampling limitation identified was that the teacher sample unintentionally consisted mainly of mathematics and science teachers. It was my intention to include teachers from various subjects so that the sample could be representative. Another criterion used in choosing the sample was that teachers should be frequent computer users. This criterion seemed to have inadvertently overwritten the subject criterion. Apparently, science and mathematics teachers are the ones using computers more frequently than the rest of the teachers in the schools.

A second limitation of this study has been lack of probability sampling and as such the data lack representativeness, and the findings lack generalisability. The sampling had to be purposive, since the phenomenon under study is new in schools and only a few schools revealed an in-depth understanding of the issue due to some relatively broad experience. However, the purpose of the study as it has been indicated, is not to make statistical inferences, but to highlight and understand the key enabling and constraining factors in ICT implementation in schools, and so purposive sampling is suitable for the study.

The third limitation is that the ICT implementation phenomenon studied is a rapidly changing and evolving theme. Therefore, data collected in this study is a snapshot in time and may be out of date very soon. Anybody who wishes to use the information in this report must verify it first from the concerned schools.

Majority of responses in regard to what seemed to enable or constrain the use of computers in schools came from School A and C teachers. Due to the lack of teachers' computers in School B and difficulty in accessing computer laboratory computers, experiences of teachers in this school were a bit limited and therefore had relatively very little to offer in relation to what was constraining or enabling their use of the technologies. This reduced data collected from teachers to inform planning of teacher professional development. This limitation was compensated for by inclusion of an extensive literature.

## ***6.6 Suggestions for further research***

While analysing and documenting findings from this study I became aware that some of the findings were self-explanatory and clear and some were interesting to delve into but were outside the scope of this work. Three of these ideas which warrant further research are discussed here:

- Teachers have indicated that learners' interest and motivation encouraged them in continuing to use ICTs in the classroom. Just as teachers' perceptions, challenges and preferences of training can assist in the design of appropriate teacher professional development strategies for teachers, so a better understanding of how learners perceive their use of ICTs can highlight some appropriate approaches for classroom implementation of ICTs. The results of this study can provide preparatory work for investigation of learners' perceptions on ICT implementation at the sampled schools and other schools.
- The most frequent use of computers is seen in School A where there is an Internet connection. Teachers indicated using the Internet daily to search for lesson plans and other websites for teaching purposes. Perhaps connection to the Internet in most or all schools can be provided to facilitate this preferred use. This needs further research once there are more schools connected to the Internet.

- The majority of the sampled teachers are science and mathematics specialists. Clearly, there is an inclination of these teachers to use ICTs: but since the methodology employed in this study and its scope allowed only a few schools to be used no generalisation can be made. Further research is required in this regard in order to make a substantial claim.

## **6.7 Lessons learned**

As a researcher, I was interested in gaining understanding and insight into an educational issue, and in this instance, ICT implementation in secondary schools. The lessons learned in this study have emerged from the research approach, the literature review and the findings.

My growing awareness of the value of case studies in educational research with its emphasis on a complete description of a phenomenon (Bassey, 1999) and its strength in that methods used in a case study can catch unique features that may otherwise be lost in larger sample studies such as surveys (Cohen *et al.* 2000) has revealed the aspects of ICT implementation which were not anticipated and therefore, not planned for in data collection methods. I did not anticipate the impact of external factors such as the MoE, parents and private companies on principal leadership: hence my data collection instruments did not plan to elicit comments about these factors. However, these factors were revealed in the interviews with principals.

External factors such as private partnerships with computer companies, MoE and parents have had some negative and positive impact on technology leadership. These external agents however, could be used to the advantage of the schools as has been learned from developed countries. Schools in these countries have strong external support from the central government, the local education authorities and public-private partnerships (Kearns, 2002).

Two of the principals wanted to keep the interview schedules. The interview schedules were seen as a guide to check whether or not all implementation issues covered in the schedule were taken care of during ICT implementation at the school e.g. technical support, teacher training plan etc. This shows how desperate principals are for some form of ICT guidance from managers. In fact, one principal indicated that he was glad that I came to the school because the interview had raised awareness on certain important implementation issues that the school was not aware of.

Principals have highlighted certain benefits of computers to their schools. Learners in one school have taken the responsibility of compiling the school's newsletter from the secretary because they enjoy and have developed skills of writing a newsletter on a computer. Principals have also indicated that with computers in the schools some administrative work has become more efficient such as locating minutes for the next meeting.

My focus on key issues and the themes that emerged in this study required me to dig deeper and so improved my computer researching skills. I constantly wanted to know more: and I realized the necessity of developing these skills in teachers I work with as a teacher advisor.

The findings in this study have highlighted the preference of use of ICTs for administration purposes. I have always believed that improving the administration and communication processes at schools can improve the school's performance tremendously, and with ICT, this improvement can be enhanced. My role is now to convince the MoE of the role of ICTs in developing effective management and administration of schools. I think this is the way to start: integrating ICTs into the administration processes of schools. This will not be difficult as improving the efficiency and effectiveness of management of schools is one task of the Advisory Service where I work as a science advisor.

### ***6.8 Value of the research***

This study has made me conversant with the issues framing ICT implementation in schools. The role of the principal, teachers and external agents to the school has been addressed. I have come to understand the process of ICT implementation both from the critical review of the literature and the practical research. But I realize that this is only part of the whole story of ICT implementation, there is still a lot more to learn from the vast literature available on the subject. This has placed me in a position where I can offer basic advice on the issue, and has raised awareness on the resources available on the subject for later reference. Hopefully, the recommendations made will assist principals and the MoE in planning for and addressing the challenges identified in the case schools and other schools during their interventions.

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# APPENDICES

## Appendix A: Van Melle's Model

Moving forward <span style="float: right;">→</span>			
	Exploring uses of ICT	Expanding uses of ICT	Extending uses of ICT
ICT is used to enhance student learning	<ul style="list-style-type: none"> <li>• Computer technology initiatives are independent, isolated, and not linked to student needs or systemic developments</li> </ul>	<ul style="list-style-type: none"> <li>• Computer technology initiatives are clearly linked to student needs and systemic developments</li> </ul>	<ul style="list-style-type: none"> <li>• Computer technology initiatives are used to increase interactive and collaborative learning</li> </ul>
ICT is an integral aspect of teaching	<ul style="list-style-type: none"> <li>• Computer technology initiatives are focused on skill building and on use of instructional and productivity software or hardware</li> <li>• Primary use of technology occurs in self-contained computer labs</li> </ul>	<ul style="list-style-type: none"> <li>• Computer technology initiatives are focused on developing curriculum plans that include an integrated use of appropriate computer technology</li> <li>• Use of computer technology occurs in a variety of settings and activities</li> </ul>	<ul style="list-style-type: none"> <li>• Computer technology initiatives complement constructivist and learner-centered approaches to teaching</li> <li>• Use of computer technology permeates the culture of the school</li> </ul>
Professional support is ongoing	<ul style="list-style-type: none"> <li>• Coordinated professional development activities focus on skill development</li> <li>• Technical support is focused on specific applications of computer technology</li> </ul>	<ul style="list-style-type: none"> <li>• Professional development is specifically designed to focus on developing knowledge, skills, and understanding of integrative uses of computer technology</li> <li>• Technical support is focused on comprehensive needs of the school</li> </ul>	<ul style="list-style-type: none"> <li>• Teachers are involved in sharing their expertise with other schools</li> <li>• Teachers have ICT qualifications</li> <li>• Technical support is an integral part of the school</li> </ul>
Planning, budgeting, and evaluation are key organizational activities	<ul style="list-style-type: none"> <li>• Planning is focused on getting sufficient funding for immediate initiatives</li> </ul>	<ul style="list-style-type: none"> <li>• Planning and funding requests are based on clearly-defined goals and purposes</li> </ul>	<ul style="list-style-type: none"> <li>• Planning and funding requests are guided by a clear vision of purposes, planned goals, benefits of goals, and of how these will be assessed</li> </ul>
ICT infusion is supported by collaborative efforts	<ul style="list-style-type: none"> <li>• Computer technology initiatives are based on individual efforts</li> </ul>	<ul style="list-style-type: none"> <li>• Computer technology initiatives are based on collaborative efforts among all those who affect student learning</li> </ul>	<ul style="list-style-type: none"> <li>• Computer technology initiatives are based on collaborative efforts including community interests</li> </ul>

## Appendix B: A synthesized model of technological infusion

Context Factors	EXPLORING		EXPANDING		EXTENDING	
	Stages	Reference	Stages	Reference	Stages	Reference
1. ICT used to enhance student learning	Incidental and isolated use of ICT by one or more teachers	Mooij & Smeets, 2001	Integrating ICT into teaching & learning	Mooij & Smeets, 2001		
	Entry phase	Dwyer <i>et al.</i> , 1990	Adaptation phase	Dwyer <i>et al.</i> , 1990	Adaptation phase	Dwyer <i>et al.</i> , 1990
2. ICT an integral aspect of teaching	The technological model	Yeun <i>et al.</i> , 2003	The catalytic integration model + the Cultural innovation model	Yeun <i>et al.</i> , 2003	The catalytic integration model + the cultural innovation model	Yeun <i>et al.</i> , 2003
	Emerging AND Applying ICT in school practice	UNESCO, 2002	Ensuring enough support + didactic innovation AND Integrating ICT in teaching & learning	Mooij & Smeets, 2001	Transforming ICT practice	UNESCO, 2002
	Infusing ICT practice	UNESCO, 2002	Infusing ICT practice	UNESCO, 2002	Adaptation phase	Dwyer <i>et al.</i> , 1990
	Entry & Adoption phase	Dwyer <i>et al.</i> , 1990				
3. Professional support is ongoing	The technological model	Yeun <i>et al.</i>	The catalytic integration model	Yeun <i>et al.</i>		
	Emerging and Infusing ICT practice	UNESCO	Increasing ICT awareness throughout the school AND Ensuring enough support + didactic innovation	Mooij & Smeets, 2001		
			Emerging ICT practice	UNESCO, 2002		
4. Planning, budgeting and evaluation are key organizational activities			The catalytic integration model	Yeun <i>et al.</i> , 2003	The cultural innovation model	Yeun <i>et al.</i> , 2002
			Appropriation phase	Dwyer <i>et al.</i> , 1990	Appropriation phase	Dwyer <i>et al.</i> , 1990
5. ICT infusion is supported by collaborative efforts	Emerging use of ICT	UNESCO, 2002	The catalytic integration model	Yeun <i>et al.</i> , 2003	Infusing AND Transforming ICT practice	UNESCO, 2002

## Appendix C: Letter of consent to principals

Mafeteng Resource Centre  
P.O. Box 13  
Mafeteng  
900.  
24<sup>th</sup> July 2006.

The Principal

.....  
.....  
.....

Dear Sir/ Madam

I am a student at Rhodes University, and pursuing a Masters in education (ICT). The purpose of my research is to establish what enabling and constraining factors schools are coming across in the implementation of ICTs (computers) in schools.

Your school was identified by NCDC as one of the schools that is well equipped and that has performed better in Computer Education. I therefore, would like to collect rich data from your school.

The study will consist of questionnaires for three teachers and the teacher responsible for computer education on the first day, and an interview of the principal on the second day. The study is not concerned with an evaluation of any individual principal, teacher, or school. No information provided by the principal or teachers will be presented in any way that could identify them or the school. Participants will be informed that they may withdraw from the process at any time.

I would like to undertake my research at your school on two days from the .....to the .....August 2006. Would these days be convenient?

If you have any queries, please do not hesitate to contact me at [Mafeteng@advisor.org.ls](mailto:Mafeteng@advisor.org.ls) or 22701576(W) or 22701214 (H) or 63121977(Cell) OR my supervisor, Prof. Cheryl Hodgkinson-Williams, at [c.hodgkinson@ru.ac.za](mailto:c.hodgkinson@ru.ac.za) or +27466038383 (W) or +27466229567.

Yours truly,

'Matsitso Kalake

## Appendix D: Computer Teachers' Questionnaire

### Questionnaire

COMPUTER TEACHER

Questionnaire No.

1. School \_\_\_\_\_ FirstName \_\_\_\_\_

Surname \_\_\_\_\_

Contact No. \_\_\_\_\_

### 2. Experience

2.1 When did you start using a computer?

Less than a year ago

1 to 2 years ago

3 to 4 years ago

5 to 6 years ago

7 to 10 years ago

More than 10 yrs ago

2.2 How did you learn to use a computer?

I have taught myself

Training courses offered by MoE

Training at my school

Learnt from colleagues

Other. Please describe \_\_\_\_\_

2.3 How did you become an IT Teacher at your school?

Applied to the advertised post

Came to school looking for a job

Appointed by teaching staff

Appointed by administration

Other. Please describe \_\_\_\_\_

2.4 Briefly describe what tasks you perform on a daily basis

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

2.5 How often do you use a computer for:

Never Monthly Weekly Daily

Communication?-----

Teaching?-----

Administration?-----

Entertainment?-----

2.6 Overall, my colleagues:	Agree	Disagree	Unsure
Use computers in their daily lives	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Are competent computer users	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Think computers are useful in teaching	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

2.7 What do you usually do when you have a problem with a computer? (Select all that apply)

- |                       |                          |                               |                          |
|-----------------------|--------------------------|-------------------------------|--------------------------|
| Ask a colleague       | <input type="checkbox"/> | Problem-solve myself          | <input type="checkbox"/> |
| Ask a friend          | <input type="checkbox"/> | Consult the manual/help pages | <input type="checkbox"/> |
| Contact IT specialist | <input type="checkbox"/> | Other.                        | _____                    |

2.8 What aspects of your **experience of using a computer** enable you to use ICTs Effectively?

1. \_\_\_\_\_
2. \_\_\_\_\_
3. \_\_\_\_\_

### 3. Hardware

3.1 What is the total number of computers you have at the school?

3.2 How many computers do you have for:

- |                |                          |
|----------------|--------------------------|
| Administration | <input type="checkbox"/> |
| Teachers       | <input type="checkbox"/> |
| Learners       | <input type="checkbox"/> |
| Support Staff  | <input type="checkbox"/> |
| Community      | <input type="checkbox"/> |

3.3 When did you receive/purchase the computers?

- |                      |                          |                  |                          |                        |                          |
|----------------------|--------------------------|------------------|--------------------------|------------------------|--------------------------|
| Less than a year ago | <input type="checkbox"/> | 1 to 2 years ago | <input type="checkbox"/> | 3 to 4 years ago       | <input type="checkbox"/> |
| 4 to 5 years ago     | <input type="checkbox"/> | 6 to 7 years ago | <input type="checkbox"/> | 8 to 9 years ago       | <input type="checkbox"/> |
| 10 years ago         | <input type="checkbox"/> |                  |                          | More than 10 years ago | <input type="checkbox"/> |

3.4 How did you receive/purchase computers in your school?

- |                         |                          |                       |                          |                   |                          |
|-------------------------|--------------------------|-----------------------|--------------------------|-------------------|--------------------------|
| Purchased by the school | <input type="checkbox"/> | Donated by government | <input type="checkbox"/> | Donated by an NGO | <input type="checkbox"/> |
|-------------------------|--------------------------|-----------------------|--------------------------|-------------------|--------------------------|

Other (Specify) \_\_\_\_\_

3.5 Are all the school computers working? YES  NO

If not, why are some of them not working?

\_\_\_\_\_

\_\_\_\_\_

3.6 Where are these computers located in the school? *Tick all the appropriate options*

Computer laboratory

Science Laboratory

Staffroom

Administration Office

Others (Specify) \_\_\_\_\_

3.7 How many computers have the following devices?

CD-ROM drive  CD Writer  DVD drive  USB port

Sound Card

3.8 How many of these peripheral devices are available?

Printers  Scanners  Digital Cameras  Beamers

Flash Memory Sticks  Others (*specify*) \_\_\_\_\_

3.9 What aspects of **hardware** enable or hinder your work?

3 ENABLERS	4 HINDRANCES
1.	1.
2.	2.
3.	3.

## 4. Software

4.1 How many of the computers at school run on the following operating systems?

Windows 2000  Windows XP  Mac OS X (Apple)  Linux

Others (specify) \_\_\_\_\_

4.2 What application programs run on the computers?

MSOffice 97  MSOffice 98  MSOffice 2000

Others (specify) \_\_\_\_\_

4.3 Which of the software below is available for administration, teachers, and learners?

Software Type	Admin	Teachers	Learners
Word Processing, desktop			
Spreadsheet Software e.g. MS Excel			
Database software e.g. MS Access			
Graphics			
Drill and practice programmes			
Tutorial programmes, self-learning			
Real-world simulations			
Internet browser			
Encyclopaedia on CD-ROM			
Presentation software e.g. MS Powerpoint			

4.4 Name subject-specific software you have at the school.

SUBJECT	AVAILABLE SOFTWARE

4.5 Does the available software meet all your requirements? YES  NO

If not, why? \_\_\_\_\_

4.6 What particular software problems are preventing the school from achieving their computer-related goals?

1. \_\_\_\_\_
2. \_\_\_\_\_
3. \_\_\_\_\_

4.7 What aspects of software are enabling you to achieve your computer-related goals?

1. \_\_\_\_\_
2. \_\_\_\_\_
3. \_\_\_\_\_

## 5. Connectivity and Access

5.1 Do you have internet connection at your school? YES  NO

5.2 How many of the computers you have are connected to the internet?

5.3 Which users at the school have access to the internet? *Tick all that apply*

Administration  Teachers  Computer Teacher  Learners

5.4 Why are some of the users above excluded from the use of computers, if any?

5.5 What type of Internet connection do you have?

Dial up  Leased line  Other. Please Specify \_\_\_\_\_

5.6 How can you rate the speed of internet connection at your school?

Very Poor  Poor  Good  Very good

5.7 How often do you use the internet at school?

Never  Monthly  Weekly  Daily

5.8 Do you have access to the internet every time you want to use it? YES  NO

If NO, please say why? \_\_\_\_\_

5.9 Do you have access to a computer anytime you want to use it? YES  NO

If NO, please say why \_\_\_\_\_

5.10 Do you have access to a computer at home? YES  NO

5.11 Can you connect to the internet at home? YES  NO

**5.12** What aspects of **Connectivity and access** support or hinder you in the use of ICTs?

Things that <b>support</b> me	Things that <b>hinder</b> me
1.	1.
2.	2.
3.	3.
4.	4.

**6. Security and Maintenance**

6.1 Are all the computers at the school working? YES  NO

6.2 Why are some not working?

- They are outdated  They are not compatible with other computers   
 They are broken  Teachers/students do not know how to use them

Other reason \_\_\_\_\_

6.3 What do you do with computers that are faulty?

---



---



---

6.4 Where are computers kept at the school? *Tick all that apply*

- Computer Laboratory  Science Laboratory  Staffroom   
 Principal's office  Staffroom  Where else? \_\_\_\_\_

6.5 What security measures have been employed at places where computers are located?

1. \_\_\_\_\_  
 2. \_\_\_\_\_  
 3. \_\_\_\_\_

---

**7. Sustainability**

- 7.1 Do you have an annual budget for the purchase of hardware and software? YES  NO   
 7.2 Is there an ICT training plan for teachers at the school or elsewhere? YES  NO   
 7.3 Is there an annual budget for training? YES  NO   
 7.4 Do teachers have access to computers after school? YES  NO   
 7.5 Does the community have access to the computers at school? YES  NO   
 7.6 Is there a charge for the use of computers by the community? YES  NO

7.7 Does the school charge learners a computer levy?

YES  NO

If yes, what is the computer levy charge per annum? M  .00

7.8 Who pays for the following expenses concerning use of ICT in the school?

Telephone as used for Internet -----

Connection \_\_\_\_\_

Electricity \_\_\_\_\_

Printing

facilities \_\_\_\_\_

7.8 Can you estimate the total cost of all the ICT equipment? M  .00

7.9 Is all the ICT equipment insured against theft, fire etc.? YES  NO

7.10 In regard to **security, maintenance and sustainability** what things encourage or frustrate you

	<b>Maintenance</b>	<b>Security</b>	<b>Sustainability</b>
<b>Encouraging things</b>	1.	1.	1.
	2.	2.	2.
	3.	3.	3.
<b>Frustrating things</b>	1.	1.	1.
	2.	2.	2.
	3.	3.	3.

## Appendix E: Teachers' Questionnaire

Teachers

Questionnaire No.....

### 1. General Information

1.1 Name of School \_\_\_\_\_ First Name \_\_\_\_\_ (optional)

1.2 Surname \_\_\_\_\_

Contact Phone \_\_\_\_\_

1.6 Please indicate your gender: Male  Female

1.7 Indicate your age group 20-29  30-39  40-49  50-59  60+

1.8 For how long have you been teaching? ----- Yrs

### 2. Computer Competencies

Please indicate how often you use computers in preparing for your teaching your classes or in other professional activities: *Indicate with a tick*

I use computers to:	Never	Occasional	Weekly	Daily	NA
Make worksheets or rubrics for learners					
Type lesson plans, notes or timetable					
Correspond with parents/guardians					
Record and/or calculate learners marks					
Draw graphs					
Create posters, notices, invitations					
Develop electronic presentations or overhead transparencies					
Send and receive e-mail					
Search for lesson plans or websites for learners					
Exchange computer files with colleagues					

NA = Not Applicable

### 3. Training/Past Experience

3.1 How would you describe how you acquired the computer skills you already have?

Tick all the appropriate options

- A. Formal college/university as part of main course
- B. ICT literacy course at college/university
- C. Self initiative at private college (part-time)
- D. Teaching self on the job
- E. In-service Training
- F. Other (specify) \_\_\_\_\_

3.2 When did you start using a computer?

- Less than a year ago  1 to 2 years ago  3 to 4 years ago   
 5 to 6 years ago  7 to 10 years ago  More than 10 yrs ago

3.3 How often do you use a computer for: Never Monthly Weekly Daily

- |                     |                          |                          |                          |                          |
|---------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| Communication-----  | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Teaching-----       | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Administration----- | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Entertainment-----  | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

3.4 What aspects of your training and past experience support or hinder your use of ICTs?

Things that support me	Things that hinder me
1.	1.
2.	2.
3.	3.

#### 4. Access and Use

4.1 Do you have access to a computer at school? YES  NO

4.2 How often do you use a computer at school?

Daily  Once a week  Once a month   
 Rarely  Never

4.3 What do you use a computer for on a regular basis at school?

Communication  Teaching  Administration  Recreation

4.3 Do you have a computer at home? YES  NO

4.4 If yes, what do you use a computer for at home?

Communication  Teaching Preparation  Administration  Recreation

4.5 Would you say you have access to a computer every time you want to use it for teaching? YES/NO

4.6 If NO, why not?

4.7 How often do you use the internet for teaching purposes?

Daily  Once a week  Monthly?   
 Rarely  Never

4.8 For what purpose do you use the internet?

Communication  Research for instructional purposes

4.9 What aspects of **access and use** support or hinder your use of computers?

Things that support me	Things that hinder me

#### 5. Professional Development

5.1 Which of the following goals/objectives appear in the school's intended ICT curriculum?

To prepare learners for future jobs-----

To improve student achievement-----

- To promote active learning strategies-----
- To individualize student learning experiences-----
- To encourage more cooperative and project-based learning-----
- To develop student independence and responsibility for own learning-----
- To give students drill and practice exercises-----
- To make the learning process more interesting-----

5.2 Is there any ICT-related training at your school or elsewhere? YES  NO

5.3 If yes, how regular is the ICT-related training of teachers?

- Once a fortnight       Once a month       Once a quarter
- Once in 6 mths       Once a year       Other-----

5.4 Is your training adequate for the ICT curriculum at the school? YES  NO

5.5 Is there a training plan and annual budget for ICT training? YES  NO

5.6 Who decides on the type of ICT training required by teachers?

- Principal       Board       Computer Teacher       Teachers

5.7 Does the school have a written ICT policy? YES  NO

5.8 If yes, who were involved in the formulation of such a policy?

- Principal       Computer Teacher       Teachers       Students

Others. Specify. \_\_\_\_\_

5.9 What aspects of **professional development** would you say encourage or frustrate you?

Things that encourage me	Things that hinder me
1.	1.
2.	2.
3.	3.
4.	4.

## 6. Teacher Support

6.1 Who decides on the ICT hardware and software to be purchased for the school?

- Board       Principal       Computer Teacher       Teachers

Other. Please specify-----

6.2 Do all staff members have access to computers in the school? YES  NO

6.3 If no, why are some excluded from the use of computers? \_\_\_\_\_

6.4 Can staff members freely use computers even after school hours? YES  NO

6.5 If NO, why not? \_\_\_\_\_

6.6 In using ICT more often than not one needs assistance. Who do you get help from?

The Principal  Computer Teacher  Computer Technician

Another teacher  Student  Other \_\_\_\_\_

6.7 How would you classify your principal regarding the use of a computer?

Frequent user  Moderate user  Seldom user  Non-user

6.8 Does your principal attend training courses or conferences on ICT? YES  NO

6.9 If YES, does he give a report of the conferences to the members of staff? YES  NO

6.10 Is there time allocated for teachers to report on their ICT achievements to the whole staff?

YES  NO

## 7. Learner Support

7.1 Have some learners at your school demonstrated some experience with the use of computers prior to introduction of computers? YES  NO

7.2 If YES, how do they compare with other learners?

Better users  Same as others  Poorer users

7.3 Do all learners have access to computers? YES  NO

7.4 If no, why are some learners denied access? \_\_\_\_\_

7.5 Are the learners allowed to use computers after school hours? YES  NO

7.6 What computer skills are your learners expected to attain by the end of Form 5?

Operating a computer (saving files, printing, keyboard)

Writing documents with a word processor (typing, editing, layout)

Making illustrations with graphics programs

Calculating with spreadsheet programs (sheet creation, using formulas)

Communicating via e-mail with teachers and other learners

Searching for and using electronic forms of information

7.7 Who troubleshoots learners' ICT problems?

Principal  Computer teacher  Teachers  Other learners

7.8 What aspects of **teacher and learner support** enable or hinder you in the use of ICTs for teaching?

Things that enable my teaching	Things that hinder my teaching
1	1
2	2
3	3
4	4

## 8. Your Final Word

8.1 What can you say is your strongest motivation in using ICTs in the teaching of your subject

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8.2 What are you proud of in using these ICTs in teaching and learning?

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8.3 What are the challenges in using the ICT tools?

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8.4 Give your honest opinion about use of ICT in your subject as expressed in the following statements.

Tick the appropriate box

SD = strongly disagree

D = Disagree

N = Neutral

SA = Strongly Agree

A = Agree

	<i>SD</i>	<i>D</i>	<i>N</i>	<i>SA</i>	<i>A</i>
Teaching can go on without the use of ICT					
ICT is a must for teaching and learning					
Bringing ICT to the classroom is a hassle					
The curriculum is fine without mention of ICT					
Use of ICT for teaching should be made compulsory					
If ICT is used in my subject it will be impossible to finish the syllabus					
ICT for teaching and learning is for developed countries					
ICTs are not having an impact on learners' achievement					

## **Appendix F: Interview schedule for principals**

### **Interview Schedule: Principals**

1. Do you have a need to use a computer on a regular basis?
2. For what purpose do you use a computer on a regular basis?
3. How often do you use a computer?
4. When did you start using a computer?
5. What type of computer training have you received and how long was the training?
6. Do you have access to a computer at home?
7. Why did your school start using computers?
8. How many computers do you have at the school for the administration, teachers and learners?
9. How did you obtain the computers?
10. How many computer peripherals (printers, scanners, cameras...) and are they adequate for your needs?
11. Does the school have subject-specific software?
12. Are computers available all the time for the different users?
13. Is the community involved in anyway in the implementation of ICTs in the school?
14. Are all the computers at the school working and where do you get help from if there is a technical problem?
15. How regular is the maintenance of the computers?
16. What security measures have been put in place where the computers are kept?
17. Are you satisfied with the security measures you have employed?
18. Do majority of teachers use computers with learners or by themselves?
19. Is there a guide to assist teachers as to what they have to do with learners?
20. Has there been training for teachers and is it continuing?
21. Do you think it is necessary to have continuous computer training for teachers?
22. Are you familiar with the training material that has been given to teachers?
23. Is the training adequate for their needs and the needs of the learners?
24. Who would you say benefits the most from the use of computers?
25. Does the school have a written ICT vision and policy?
26. Does the school have an annual ICT budget? What ICT- related items does the school pay for?
27. Does the school charge a computer fee?
28. Has your management style changed since the use of computers?
29. What challenges have you come across in the implementation and use of computers?
30. How has the school, teachers and learners benefited from the use of ICTs?

**Appendix G: Principal A interview transcript**

**Principal A Interview Transcript**

1 R: Do you have a need to use a computer on a regular basis?  
2 P: Yes of course I do  
3 R: For what purpose do you use a computer on a regular basis?  
4 P: I use it for office work, for keeping day-to-day school records. Also for teaching, I  
5 use it as a teaching tool, and I use it in a classroom where I write the notes for my  
6 students and sometimes even for class-work  
7 R: How often do you use it?  
8 P: Everyday  
9 R: On a daily basis?  
10 P: On a daily basis, yes everyday  
11 R: When did you start using a computer?  
12 P: In 1997. I underwent a course in computers at Quadrant in Maseru  
13 R: How long was your training?  
14 P: I think it was a two or three month course.  
15 R: Are there any training courses at the moment; training courses for principals on the  
16 implementation of computers in schools?  
17 P: No, ever since I assumed this position, no (He became principal only at the  
18 beginning of this year when the former principal retired).  
19 R: Do you have access to a computer at home?  
20 P: No I don't have one  
21 R: When and why did your school first start using computers?  
22 P: 2005  
23 R: How many computers do you have at school?  
24 P: 25 in all  
25 R: How did your school go about obtaining computers?  
26 P: It was a gift by NEPAD, Oracle e-school. I think it is a project; an e-school project.  
27 R: How many administration staff computers do you have?  
28 P: Probably 2  
29 R: How many for teaching staff?  
30 P: For teaching staff there are two, besides those that are in the lab.  
31 R: And learners?  
32 P: 21 computers  
33 R: How many peripherals are there at your school? That is printers, scanners.....  
34 P: I think there is one in the media centre, one in the principal's office, one in the  
35 secretarial office, one in the staffroom and one in the lab, meaning that there are about  
36 5 printers.  
37 R: Any scanners?  
38 P: There is one scanner in the principal's office  
39 R: Are these peripherals adequate for your school's needs?  
40 P: No they are not enough; especially the scanners  
41 R: What aspects of hardware; of these things we have discussed; the number of  
42 computers, the scanners, the printers, enable or hinder the school from the effective  
43 use of ICTs?  
44 P: I think it is the inability to operate them; to make use of them  
45 R: Is that what you see as a hindrance?  
46 P: Yes it is a hindrance; also lack of interest among members of staff, as for students  
47 they are very interested. It is just that they don't have people who guide them,  
48 especially the subject teachers, because the teacher for computers does not have a  
49 problem.  
50 R: Other than the computer teacher other teachers do not use computers with learners?

51 P: Most of them don't, just few. They don't visit the computer lab regularly or make  
52 use of the media centre regularly.

53 R: And that you would say it's because of lack of interest?

54 P: Lack of interest because training was offered at the beginning of this year on all  
55 aspects

56 R: By whom?

57 P: By the computer, should I say, expert here on campus

58 R: Is that the person you call the Computer Teacher?

59 P: Yes and also members of the NEPAD group, that is, those teachers that underwent  
60 training in Maseru in August last year.

61 R: How many were they?

62 P: They were five (5) including the computer teacher

63 R: What is the difference between the media centre and the laboratory?

64 P: The laboratory houses computers and printers only but the media centre includes a  
65 TV set, computers and others, actually they call it the multimedia centre.

66 R: Does the school have any subject specific software to be used by teachers and  
67 learners?

68 P: I think so because the number of software in computer, actually the computer  
69 teacher is interested in teaching students a number of aspects besides those which deal  
70 with content in the specific subject areas, but with computer he is teaching them those  
71 things.

72 R: Is the school connected to the internet?

73 P: Of course, that's what we are proud of!

74 R: How many computers in all are connected to the internet?

75 P: 25, that means all of them are connected.

76 R: Are there separate computers for junior and senior classes?

77 P: They all use the same staff. They have access to all of them irrespective of level.

78 R: Do all users have access to the internet that is teachers, learners, and administration  
79 staff?

80 P: Yes they do, all of them do have that access

81 R: How often do you use the internet and for what purpose?

82 P: I realise that it is used everyday; it's either for learning, for teaching, or for  
83 personal purposes like sending e-mails and so on, checking results. I think they all  
84 have access for a variety of purposes

85 R: What do you mean checking? Who is checking results?

86 P: Teachers who have access and are studying check their own results. Those who  
87 have children attending tertiary institutions do so. Others do have e-mail addresses  
88 and may send e-mails to their friends or whoever.

89 R: Do they have access to this internet every time they want to use it?

90 P: Of course they do

91 R: Even after school hours?

92 P: Yes, that's even when they have ample time to surf the internet

93 R: Is the laboratory open all the time for anybody to use it?

94 P: Yes the computer teacher is always available to assist those who want to go there  
95 even after school hours.

96 R: So he doesn't go home himself?

97 P: Since he resides on campus, he is always available. Even other teachers have  
98 access to take their children to the computer lab besides members of the community.

99 R: Oh! So you do have members of the community who come?

100 P: They do come but not often, very few, because we haven't started a full scale  
101 project including members of the community.  
102 R: But you intend to?  
103 P: We intend to as time goes.  
104 R: And how would you describe the community, the type of community that would be  
105 coming to the school to access the computers?  
106 P: We refer to teachers from other schools or neighbouring schools, students,  
107 especially at tertiary institutions and-----  
108 R: What aspects of connectivity and access encourage or frustrate you in the use of  
109 ICTs? That is internet use, are there issues that you think frustrate you?  
110 P: There is a tendency to venture into stuff involving pornography and others. I think  
111 that is the only thing; and also most people tend to focus on non-academic issues  
112 mostly and yet the project is intended to be an engine for academic excellence.  
113 R: Any other thing?  
114 P: They like to check these celebrities who appear on television, I think they like such  
115 things, but on the whole it is not a big deal.  
116 R: Do you have any regulations or rules regarding the use of the internet?  
117 P: They are there, there are rules pertaining to students not being allowed to-----  
118 ----actually things that frustrate us mostly are when people have ventured into  
119 unauthorised things such as pornography which may result in the closure of the entire  
120 project.  
121 R: Would you really need to close it or just regulate it somehow?  
122 P: I think the most important thing is to have regulatory means rather than closing it  
123 totally  
124 R: What would you say are the benefits of having access to the internet by the learners  
125 or teachers?  
126 P: Through this program, called Think.com learners are able to interact with their  
127 counterparts from across a diverse international spectrum. I think that is one for the  
128 students. They send messages; they interact with students from other countries, that is  
129 another thing. Also for learning, they do research on the computers in their different  
130 subjects, even for copying things such as notes. I think computers facilitate learning.  
131 For teachers, I think the laboratory has been brought closer to teachers through this  
132 internet, especially people who teach science subjects. I think they have better  
133 experiments reflected on the screen and through the use of the projector they are able  
134 to enhance their teaching.  
135 R: Are all computers at the school working?  
136 P: Yes, they are all working  
137 R: Do you have a technician locally or elsewhere?  
138 P: We have a technician, I think the teacher partly, to an extent has that technical  
139 know-how. However we rely mostly on those from Oracle in South Africa  
140 R: They are based in South Africa?  
141 P: Yes  
142 R: Ok. What technical problems do you deal with regularly?  
143 P: I think the one that is being dealt with by our expert, the teacher it's a matter of  
144 dealing with the software but if it is at a higher level we call Oracle technicians.  
145 R: How fast do you get technical help once you have told them you have a problem?  
146 P: It is delayed in most cases. They will come twice a year, this means when they are  
147 here they attend to the problem but they don't respond quickly.  
148 R: What security measures have been put in place where computers are kept?

149 P: Some of them have things like locks where they are locked. We also have  
150 electricity. I think electricity is the major one, we have alarms. Basically, we have the  
151 security guards who are always available who were contracted by the school.  
152 R: So these are paid by the school?  
153 P: Yes, they are paid by the school  
154 R: Has there been any tampering with the computers or places where are they are  
155 stored so far?  
156 P: No so far we haven't experienced any?  
157 R: Are you satisfied with the maintenance and security measures that have been  
158 employed, that is you have the guards, you have the locks----  
159 P: I think we still have to go an extra mile, by way of installing alarms and contracting  
160 fully qualified security guards.  
161 R: You said majority of teachers do not use computers with learners but the few that  
162 use computers with learners do they have a guide or curriculum to assist them as to  
163 what do with learners?  
164 P: Yes, Oracle Trainers provided the school with a package containing all information  
165 pertaining to the use of computers.  
166 R: It's available at the school?  
167 P: It's available and each teacher has a file, it's a big file.  
168 R: Ok, What do the teachers use the computers for with the learners?  
169 P: Basically for content, the teaching content  
170 R: Is there subject-specific content?  
171 P: Yes  
172 R: For every subject at the school?  
173 P: I think every subject besides Sesotho has content  
174 R: Have teachers been trained?  
175 P: Yes, they were trained at the beginning of the year, but not regularly  
176 R: Who supplied the training?  
177 P: The training is offered by first the computer teacher and other members of staff  
178 who underwent training in Maseru by Oracle  
179 R: Are you familiar with the training material that has been given to teachers?  
180 P: Personally? Yes I was one of those who attended the training  
181 R: So you can give me material from this training?  
182 P: Yes I can do so  
183 R: Is the training for teachers adequate for their needs and the needs of the learners?  
184 P: I do think that it is adequate despite the fact that it is not fully --- You cannot say it  
185 is a project that can fully help teachers. Teachers still have to complement  
186 somewhere; it's not a fully complete one.  
187 R: So how have you tried to complement the Oracle training?  
188 P: I think because in some areas you may find that the information is very  
189 controversial, let me say, not fully correct, so to conscientize teachers about that we  
190 had a training at school here showing them that they shouldn't fully rely on the  
191 information given; they still have to undergo research elsewhere  
192 R: You mean the Oracle material is controversial?  
193 P: Yah, it is controversial in the sense that they may say something is like this until  
194 one undergoes research in other books and you find that is not the case. So that  
195 confuses students  
196 R: Ok! Is it the most recent material that you would be referring to?  
197 P: Yes I think the most recent material, as you surf the internet you come across such  
198 things especially the science part of information

199 R: Do you think it is necessary to have continuous training of teachers in the use of  
200 computers?  
201 P: Of course, that is very important  
202 R: Does the school have any ICT vision, is it written?  
203 P: No, to be honest we don't, especially the written one, but from the information we  
204 got from the Oracle consortium personnel the vision is clear  
205 R: They have vision in those documents that they supplied, they gave to teachers?  
206 P: Although it is not clearly spelt out as vision, but it gives us direction as to where  
207 the founders of this NEPAD Oracle whatever want to go, because it focuses on the  
208 reduction of the digital divide between the developed and developing countries so that  
209 at the end of the day Africa has its own experts in the field of ICT.  
210 R: But you haven't tried to maybe, adapt it to your situation at school?  
211 P: Yah we tried to adapt it to the situation at our school so that we can have the calibre  
212 of students who are ICT conscious by the time they complete their studies  
213 R: Is everybody aware of the vision, or what you are telling me as the school or  
214 NEPAD's vision  
215 P: Actually we have that vision as a school that the computer should be the vehicle  
216 through which we attain the mission which is espoused by the African leaders, the  
217 founders of NEPAD.  
218 R: Alright. Any policy, written policy, guiding the use of computers by all members  
219 of staff and learners?  
220 P: Since we are grappling with this for the first time we have not come up with a  
221 clearly written policy  
222 R: How long have you been using the computers?  
223 P: I think in October last year, when they came everybody just jumped on them.  
224 R: So it is how many months?  
225 P: 10 months  
226 R: So I guess there is no plan, no policy and no plan?  
227 P: No, the plan is there  
228 R: So you have the plan! Is it monthly, session, annual?  
229 P: Like I said, we are grappling with this thing for the first time and I can't actually  
230 classify it, but I might say it is annual.  
231 R: It's an annual ICT plan  
232 P: Yes its an annual plan  
233 R: The plan includes---or you can give me the plan to look at later?  
234 P: Now that we don't have a vision, it was difficult to have a policy and a plan that are  
235 written. Those that we have are not written. Our plan is that we would like first of all;  
236 train the teachers, having done so, we go to students and when everybody on campus  
237 is quite conscientized on the use of computers then we can have an outreach program.  
238 R: Can you explain the outreach program?  
239 P: Whereby we involve members of the community; teaching professionals and  
240 others, that is the plan  
241 R: You want to train them?  
242 P: Yah, we want to train them. We also want to include members of the board after  
243 teachers and students so that everyone is ICT conscious.  
244 R: How would that benefit the school?  
245 P: In a sense the school is going to benefit because once the community is  
246 conscientized of the services which are provided here they will come maybe rent the  
247 use of the equipment. And also the training will involve a sort of some material  
248 benefit in the form of money for the school even for those that will be offering the

249 training. Basically that's the benefit. Number two; its going to strengthen the relations  
 250 between the community and the school, in the sense that the community is going to  
 251 reap the benefits of having an e-school project in their vicinity. I think in that regard  
 252 its going to be beneficial.

253 R: Are the learners regularly assessed on ICT?

254 P: Yah, those who do computer are being assessed. Since we are using these  
 255 computers as part and parcel of teaching, we can say it is been integrated in the  
 256 assessment that we do in other subjects because the content that students will be  
 257 having and their good results, in a sense, will imply something about their ICT  
 258 project.

259 R: Is there any Computer education assessment, monthly.....or how regular?

260 P: Yes it is there for Form As and Form Bs

261 R: Do you see achievements in teachers, maybe, learners since computers came to  
 262 school?

263 P: Actually the achievement is mostly reflected with regard to teachers; their  
 264 application of the equipment; when they apply it accordingly then the results improve.  
 265 It is true by the end of last year we didn't have quantity results, we had quality results  
 266 in the sense that we had 34% pass but the calibre of people who obtained second class  
 267 and first class obviously went to higher learning institutions given their good results.

268 R: They had several credits?

269 P: Several credits most of which were influenced by their regular, maybe use of  
 270 computers. They used to come for computers to do research even after school and  
 271 during weekends you'd to see them here, that interest I think helped them a lot.

272 R: So this was different from the previous years when computers were not there?

273 P: Yes, because we had 74% pass but majority of them couldn't be admitted in the  
 274 higher institutions.

275 R: They didn't have good credits?

276 P: Good credits. I think the quality of credits was highly influenced by the advent of  
 277 computers.

278 R: Do you have an annual budget for ICT equipment and training, this I mean some  
 279 things may break or you would need to replace a computer.....

280 P: Yah, when budgeting for this year, because computers are part and parcel of the  
 281 technical department we increased the budget in that particular department to cater for  
 282 the computer needs.

283 R: So far have you had a need to order some things, some equipment; software for the  
 284 computers?

285 P: Since we are still within the craze period, I think it's about to end, we didn't feel  
 286 obliged to spend much money on that. I think the money that we might be spending is  
 287 to buy minor things such as extension cords and others, but not necessarily the  
 288 equipment. The paper still comes from Oracle and many other things.

289 R: Who pays for the following expenses electricity, printing facilities, telephone, as  
 290 used for the internet?

291 P: I think the electricity is paid for by the school

292 R: Printing, that is the toner and the paper

293 P: Since the project was introduced we haven't spend our money, getting these things  
 294 free of charge from the Oracle people.

295 R: So when does it end, the craze period?

296 P: I may not be that accurate, but let's say by the end of this year; because it's going  
 297 to take 12 months. They were here in April, this means next year June might be the  
 298 expiry date of the craze period.

299 R: So are you already planning what you are going to do when the craze period ends?  
300 P: I think the Oracle team is dealing with the plan at the moment; they are yet to  
301 report so that we can discuss their plan.  
302 R: They are doing the plan for the school, the Oracle people?  
303 P: The Oracle team we mean those that were trained by Oracle, the NEPAD group;  
304 those teachers who underwent training are the ones who are doing the planning aspect  
305 of the entire project.  
306 R: Ok. For internet connection do you have any expenditure because I heard your  
307 connection is wireless, it is not telephone, dial-up.  
308 P: Actually everything during this period, all expenses are being borne by the Oracle  
309 people.  
310 R: But what actual expenditure is actually entailed in the wireless connection?  
311 P: Given lack of expertise in regard to this, especially that deep rooted expertise one  
312 might not be able to give a clear response.  
313 R: Maybe the computer teacher might know?  
314 P: Yah, I think he might know more.  
315 R: Does the school charge pupils any computer levy?  
316 P: No, it is not being charged; meaning included in the school fees?  
317 R: Yah  
318 P: No it is not included as yet, but given the fact that very soon we are going to be on  
319 our own we will have to include it. When we print when maybe the notes or whatever  
320 if they want such things to be printed for them they pay 50 cent per page.  
321 R: And you use the money for?  
322 P: The money is being kept for computer-related projects. It is true that at this point in  
323 time it still not being used, but it is being kept so that when we are on our own we  
324 have a starting point.  
325 R: Alright. Who would you say benefits the most from the use of computers of all  
326 these users, teachers, learners, the administration?  
327 P: I think people who benefit the most; actually I can't specify which group; but I  
328 think teachers. They no longer have to consult as many books as they used to when  
329 preparing for their own lessons. They no longer have to rely on a chalkboard which  
330 makes their clothing dirty; actually everything has been brought closer to them  
331 through the introduction of computers, all facilities are there. It is true the introduction  
332 of computers has not replaced a teacher but has strengthened, consolidated maybe, the  
333 position of a teacher and is making the teaching profession more interesting.  
334 R: Has your management style changed since the use of computers and how?  
335 P: I might not be the right person to comment but let me say it makes management  
336 easier because in the past very delicate, crucial information used to be kept on papers  
337 which used to disappear mysteriously but now we can store a lot of information on the  
338 computer. I have my personal vision which is kept in the computer. All my plans;  
339 administrative plans I write them there even the minutes pertaining to the previous  
340 board meetings, staff meetings, everything they are kept there.  
341 R: Are your computers networked?  
342 P: Yah they are networked  
343 R: You can communicate with teachers from your computer to their computers?  
344 P: No, not in that sense, not in that fashion, but information that is computers in the  
345 lab can be obtained in other computers  
346 R: Are they connected somehow so that information from you can pass on to teachers'  
347 computers?  
348 P: Not yet, but I think it can be done.

349 R: What challenges have you come across in the use of ICTs so far?  
350 P: The main challenge is lack of passion by people, especially teachers who are  
351 trained. They were given training on a number of issues pertaining to computers; they  
352 don't make use of that. They don't use the computer lab and media centre regularly  
353 R: What would you say is contributing to the lack of interest of teachers?  
354 P: I think the major thing is that before one can have a lesson in the lab, one has to  
355 make preparations first; have clear objectives, you know. I think the current calibre of  
356 teachers don't like to prepare, to make lesson plans. So this requires the teacher to  
357 come to the lab, sit down here, prepare and select necessary information from what is  
358 not necessary; so that is the issue. People are used to the old style of going to class  
359 with a textbook without preparation. So that is what is causing that. Maybe, they fear  
360 to contact the computer teacher or the expert. They did not use the expertise while it  
361 was still fresh.  
362 R: Are you intending to do something about this?  
363 P: Yah, we had a meeting with the NEPAD group, the teachers here. We decided to  
364 hold regular training sessions starting now, for those teachers.  
365 R: Who is providing the training?  
366 P: Since we have a good guideline from the files that we got from the Oracle people, I  
367 think the group itself can continue with everything.  
368 R: They train other teachers?  
369 P: Yes, they train other teachers.  
370 R: How often are these training sessions?  
371 P: We had a session whereby all teachers were trained together in the lab. After that  
372 we are using a man to man strategy, whereby we go to a certain person, we help that  
373 person. That's how it happens. One member may go to another staff member and try  
374 to help, unlike when all teachers are called to a training session because it is going to  
375 affect teaching. We go to them one by one and encourage them and say 'have you  
376 ever used this, have you ever visited the media centre recently?' So, we are trying to  
377 do that.  
378 R: So you think its working?  
379 P: Yah, for some people it works.  
380 R: Do you mean that there are teachers who still lack the passion?  
381 P: Especially to fulfil the intended mission of the project. They can play cards, but it  
382 no longer happens, I have realised. They go to their e-mails, communicating with  
383 universities, searching for lucrative jobs and so on, but they hardly deal with things  
384 for the benefit of teaching and learning and that is the core of the project; the mission  
385 of the project, to be an instrument for learning.  
386 R: Alright. What would be your final word about the whole thing?  
387 P: I think the calibre of the new breed of teachers is a factor; they don't want to  
388 prepare for anything. Another challenging thing was that of people who ventured into  
389 pornography, but it no longer happens. I think a very strong warning was given to  
390 them and they no longer do that because the computer teacher had to design  
391 passwords for different people so it is easy to know. That is another issue. But on the  
392 whole, one can say that the project is very interesting; all it requires is people who are  
393 dedicated. It also requires us to have regular training sessions with the teachers.  
394 R: Thank you very much. This was an interesting talk

**Appendix H: Principal B interview transcript**

**School B Interview Transcript**

1 R: Do you think you have a need to use a computer on a regular basis?  
2 P: Yes, I do  
3 R: For what purpose do you use a computer?  
4 P: You mean use privately or on school official matters?  
5 R: Yah, for administrative work  
6 P: No, we have the office; the secretary in the office uses it when I ask her to.  
7 R: But you don't use it yourself?  
8 P: I'm not using it myself, but I ask the secretary to use it, we have two in the office  
9 here for office business  
10 R: When did you start using a computer?  
11 P: 2002; for the school office  
12 R: So am I right to say that the secretary is the only one who uses the computer in the  
13 office?  
14 P: Yes, you are right.  
15 R: What type of tasks does she do?  
16 P: Typing letters, compiling students' reports, accounts, almost all documentation is  
17 done on the computer  
18 R: How did she learn?  
19 P: Its part of her qualification  
20 R: So you demanded somebody with some computer literacy?  
21 P: Yes, she was computer literate before we employed her as the accountant; the  
22 secretary is both the accountant and the secretary to the principal.  
23 R: Does she still attend some training?  
24 P: Yes we did that; we send her once for a workshop, training during the holidays.  
25 R: Once in the three years?  
26 P: Yes, once in the three years  
27 R: Do you know what she was trained on?  
28 P: No, I didn't ask her  
29 R: Do you have access to a computer at home?  
30 P: No, I don't  
31 R: When and why did your school start using computers?  
32 P: 2002, to keep our records up-to-date. To keep our records both on paper and on the  
33 computer so that if anything happens to the computer we can still retrieve the  
34 information.  
35 R: How many computers do you have at the school?  
36 P: The school office has 2.  
37 R: do you have any computers for the teaching staff?  
38 P: Practically, we have one for the office, the second one is for the staffroom but we  
39 haven't send it yet because we want some level of security to be there before we do  
40 that, though we have other computers in the computer lab; about 30 of them for  
41 students' learning purposes.  
42 R: How many peripherals do you have, that is printers, scanners, digital camera?  
43 P: We have one in the computer lab and one in the office.  
44 R: Any scanners?  
45 P: We have two machines for that, one photocopier and one risograph.  
46 R: Do you have a projector?  
47 P: No, no projector  
48 R: Are the peripherals adequate?  
49 P: It's not adequate, its just the starting point because the principal and the deputy's  
50 office we also need at least one.

51 R: So are you thinking of getting one?  
52 P: Yes, we have a program for that, get at least one for this office or better still, for  
53 each one of us get one, that is the computer and the full accessories.  
54 R: Is there anything in regard to hardware that is hindering your work?  
55 P: Basically if there is anything its just us, but most of the work we want done we ask  
56 the secretary to do it for us and its done. But we think if we have it, it can help us do  
57 some of the things ourselves.  
58 R: She has a lot of work?  
59 P: Of course yes, because the school is big and the account work on each student is  
60 also big. If we do some of the work ourselves, that will help her to concentrate mostly  
61 on the accounting area.  
62 R: How many computer labs do you have?  
63 P: one  
64 R: Do you have any subject-specific software?  
65 P: No, we are yet to go that level of development.  
66 R: How many years have you been using computers with learners?  
67 P: Learners we started this year so to speak  
68 R: The office bought one in 2002, the second one was a gift from LNDC as a result of  
69 our performance in the COSC results. We produced students who qualified for top ten  
70 in the country. In that year, 2002, we had four students qualifying for top ten in the  
71 country. It was an award given to the school.  
72 R: You said you don' have subject-specific software. Why not? Don't you have the  
73 need to give learners that is related to their subject to do on the computer?  
74 P: Yes we have the need. I think that will help both students and teachers. Like I said  
75 we started in a small way we are going to increase that in the coming year so that  
76 teachers also can do their work easily with the computers.  
77 R: Are you connected to the internet?  
78 P: No, because we don't have the ground line here for connection to the internet.  
79 R: How do you communicate?  
80 P: We use the mobile phones.  
81 R: Do teachers and learners have access to the computers every time they want to use  
82 them?  
83 P: At present yes, especially the As and Bs we made with them to use them after  
84 school hours. You see; this office one the teachers can use every time they want, but  
85 the ones students are using for the lessons they don't belong to the school so the  
86 teachers for the computer studies give permission to the teachers to use when they  
87 want, that's how it goes.  
88 R: So they allow them sometimes to use them after school hours?  
89 P: Yes, it's allowed. The administration does not control the use of computers wholly  
90 because it is not school property so sometimes when the teachers(computer teachers)  
91 are not available of course, you see the company has committed to the teachers and  
92 one person seeing to the efficiency of the computers. If these people are not there we  
93 cannot just authorise their use. So this creates problems for both learners and teachers,  
94 they cannot use it when it is not official time. When they want to do something after  
95 hours they may not easily access it when those teachers are not there. So to solve this  
96 problem we need to buy one or two computers for teachers to use anytime they want  
97 to do their work.  
98 R: Are all the computers working to your knowledge?  
99 P: Yes.  
100 R: Who do you contact when there is a minor problem?

101 P: The company has a coordinator. The teachers report to us and then we phone the  
102 coordinator who brings specialists to come and repair them.

103 R: Where is this coordinator?

104 P: He is in Mafeteng. We communicate to him on the phone and he comes  
105 immediately.

106 R: What security measures have been put in place?

107 P: We have two guards 24 hours so they watch over the computer lab, apart from the  
108 burglar proofing of the windows and the doorway, we have alerted our guards to  
109 watch over them.

110 R: Have you had any tampering of the computers so far?

111 P: No, not at all.

112 R: So you are satisfied with the maintenance and security?

113 P: Yes

114 R: Are the learners being assessed in computer education?

115 P: Form A is doing the syllabus to write examination at the end of the three years at  
116 J.C.(Junior Certificate), the rest of the school is just computer literacy.

117 R: Are you giving anything to the senior students to indicate that they have computer  
118 literacy?

119 P: The first company we advocated for that that they should give them some form of  
120 certificate to show that they have some aspect of computer. This company we have  
121 not told them actually. Its something that we have to tell them to do.

122 R: So this is the second company?

123 P: The first company was not doing what the board wanted them to do, so we stopped  
124 them; that was in 2004. It started 2003 and stopped in 2004.

125 R: What were they doing that you didn't like?

126 P: Well, one: we felt their teachers were not qualified enough and they were not  
127 teaching the syllabus as we wanted them to teach it. They didn't have a printer. These  
128 were about the main things. So we wanted the owner of the company to come for  
129 discussions; he refused to come. So in view of that, the board decided that we should  
130 stop. So we expect this company to do all that we want so that at the end of the course  
131 students should be able to pass. But even this company is not doing the full  
132 expectations of the school. We are particular about the students getting the right  
133 tuition and being able to pass at the end of the course.

134 R: That means there is somebody who checks regularly what the computer teachers  
135 are doing?

136 P: We want that there is somebody who checks regularly, but it is not going the way  
137 that we want because the company is not cooperating, it is the church who is doing it  
138 and they felt being the proprietor they could do it the way they wanted, and those  
139 things are not convenient for us.

140 R: I just want to confirm that there is somebody that monitors or supervises these  
141 private teachers.

142 P: Yah, that's the coordinator's responsibility. We want to supervise like we supervise  
143 other teachers but it is not going that way. Its not going as smoothly as it should go.  
144 We also proposed to the company that there should pay a small percentage of the  
145 money (paid by learners) to us but they refused

146 R: My concern was when you raised the point that you stopped working with the first  
147 company because they were not doing what you wanted them to do. So that gave me  
148 the idea that maybe one of you or some teacher is supervising how things are going in  
149 the computer lab; how children are being taught in the computer lab.

150 P: If that is part of the general school program and the company is committed for us to  
151 run and they pay some percentage to us, I think we would be able to do it better than it  
152 is today. Because, you see, that would eliminate the coordinator; we would take it as  
153 the school curriculum, run it and pay the higher percentage, the agreed percentage to  
154 the owner and then small percentage comes to the school for developmental purposes  
155 and running costs. We think that is the better one.

156 R: That is what Tsakholo is doing

157 P: But this place they said no, they will not pay a cent to us, they want hundred  
158 percent money. So this has created a problem of, you see over here, the HoD is  
159 involved and the deputy and the teachers. The HoD and the deputy are not motivated  
160 enough to do the work because it is an extra work, they feel that they do it or not they  
161 will still receive their cheques. So you want to run it and you don't want to give us  
162 anything, then do it. So there is no cooperation. The argument is that whether they do  
163 it or not they are still going to take their same cheques. So they don't mind; this is  
164 how it is.

165 R: So don't you think, maybe, you should have people, teachers who are trained....

166 P: Like any other teacher?

167 R: Yah, teachers who have shown interest, like, you gave me a name, may be you can  
168 send them for further training and even if they don't teach it then they come and  
169 supervise the computer teachers.

170 P: It will demand an allowance which is being paid for and he doesn't get anything, he  
171 will not like it. He is spending his time; his private time to supervise, he will not like  
172 it. That's a strong point, I didn't even think of what you just said. It's a good point.

173 R: Maybe they could get some portion of the computer levy.

174 P: Sure, that's what we wanted and it was not easy. The company refused, even 5%  
175 they refused; we came to 20% and it was hell.

176 R: What about these small things, the accessories; the mouse, the.....?

177 P: That one the coordinator will buy. The coordinator ensures that the full set of the  
178 computer is fine, even photocopying, even this morning he was here and the bursar  
179 told me she stopped them from doing it. They should come to do it but pay like any  
180 other people because people, the public who come here to do photocopying we charge  
181 them some money. Since it is still their company running it they can still pay some  
182 money towards such services.

183 R: Do majority of teachers use computers with learners or just by themselves?

184 P: Just by themselves. But not majority, few; one or two teachers go there to make  
185 themselves computer literate. They want to get some awareness.

186 R: Is there a guide or curriculum?

187 P: Yes, there is a guide from the Ministry of education and the COSC, Cambridge  
188 syllabus, because we are supposed to run it from Form A to Form 5. So the syllabuses  
189 are there we have given them to the computer teacher.

190 R: So you are using the Cambridge syllabus for the Ds and Es?

191 P: No, awareness will not go that far. Just same JC syllabus, and the senior  
192 forms(levels) always complain that they are being taught the same thing as the Form  
193 As, so that is some of the problems we have. Because of that they don't want to pay;  
194 they think it (what they are being taught) is too elementary, they know those things  
195 already, they feel they should know something a little bit beyond.

196 R: Are there learners that come with the computer know-how?

197 P: Yes, like I said, some of them in Form D, Form E they learned from the first  
198 computer company, so they have a little bit of information already, so that creates a  
199 problem. If they teach, the information that reaches me is they teach even the same

200 stuff for Form A and Form E and the students fight that one. For example, other  
 201 information is that they set the same examination for all the classes, because they have  
 202 taught them the same thing; so they are not motivated enough to do the computing. So  
 203 we called the teachers and brought that problem up, so this time they may be doing  
 204 different things, but last quarter they were doing the same things.

205 R: Have they just started this year?

206 P: They started around March and they are teaching the learners according to the  
 207 syllabus we got from NCDC.

208 R: Have these computer teachers being trained?

209 P: Yes, according to their documentation credentials, they hold diploma and higher  
 210 diplomas from recognised institutions.

211 R: In the country?

212 P: One here, one from St.Elizabeth and the other from the Republic.

213 R: Do you think it is necessary for them to have continuous training?

214 P: Yes, it is necessary for them to have computer continuous training

215 R: Why do you think so?

216 P: To improve themselves, to refresh themselves.

217 R: Do you have an ICT vision or plan. That is, you know where you want to be, say,  
 218 in 2yrs time regarding the use of computers.

219 P: I would say we haven't planned it, though we want to improve that, yes.

220 R: Are the learners assessed regularly?

221 P: Yes, we expect that to be done. Actually assessment in the school is once a  
 222 fortnight.

223 R: Maybe to go back to the plan question, when you first introduced the computers in  
 224 the school, why, what forced you to start?

225 P: If they learn this computing, they will be at an advantage over their counterparts  
 226 from other schools who have got any computer information. And if at that level they  
 227 are looking for a job, they will have some advantage and they will manage life better.  
 228 That's the reason we introduced it.

229 R: But you didn't sit down, like with the teaching staff and plan it properly before the  
 230 computers came into the school?

231 P: No, we planned it as much as that. We as the administration felt that we are at an  
 232 age where everybody is supposed to be computer literate, so we think it will be highly  
 233 supported by everybody. Parents supported it, teachers and learners supported it, so  
 234 we just passed it. When the idea came we thought it was good enough so we took it to  
 235 those levels. We discussed with the board, they accepted it, we went to parents'  
 236 meeting, and they accepted it. That was in 2002.

237 R: You wanted them to be computer literate and as to how literate they should be it  
 238 didn't matter.

239 P: No to run the JC syllabus and COSC syllabus just like any other subjects, so that  
 240 some of them can continue at the universities to do it as their main professional area  
 241 and those that are not able to climb to the higher ladder can use it as an advantage to  
 242 their counterparts from other schools where computers are not taught. So its both for  
 243 computer awareness and for prospective employers.

244 R: So that's why you talked about giving them certificates at the end of Form 5?

245 P: We did that with the old company. This company we will have to, but what they  
 246 have been taught this year is not enough to give certificates to Form 5. They don't  
 247 know much. They haven't covered much, it is not good to give certificates for very  
 248 basic information, its too basic, they must advance a little.

249 R: So the present Form 5s will not have certificates?

250 P: Maybe next year.  
251 R: I guess you don't have any annual budget for ICTs because you said the private  
252 company is taking care of everything.  
253 P: We have given it to the company for three years; maybe after three years we might  
254 do something better, when the computers are supposed to be school property; when  
255 we take over fully then we can do something better.  
256 R: So you are planning to take over?  
257 P: Yes, according to what the board demands, after three years the computers should  
258 become school property.  
259 R: Have you thought of the expenses involved and the planning before the three years  
260 are over?  
261 P: It will be cheaper. Right now the students pay R100.00 per quarter and we think  
262 when we come to that level the fee will be R40.00 on top to pay teachers because  
263 government may not give us a grant. That one is very easy to calculate.  
264 R: What about the purchasing of consumables, replacement of parts and so on?  
265 P: Because it is not immediate now, we think we will have time to do those ones. We  
266 can budget for it properly, maybe next year, towards the end of the three years.  
267 R: But at the moment you have not budgeted for anything.  
268 P: No we haven't.  
269 R: Who is pays for the electricity as used for computers?  
270 P: The school pays and also the security.  
271 R: What is the name of this company?  
272 P: Assemblies of God Computer Company  
273 R: Its based in Maseru?  
274 P: The computer company is here so to speak, but the leaders of the church, the ----is  
275 here and the general secretary is here in the mission, he is the pastor.  
276 R: Is the community involved in anyway?  
277 P: No the community is not involved at all. It is paying some fees only towards some  
278 services we can render to them. In fact, it has not been discussed at all levels; even  
279 nobody from the community is proposing for it.  
280 R: Do you have a written contract with the company?  
281 P: Yes, we have a written thing, which the company feels they should not .....us; for  
282 example, we want them to leave the computers for the school after three years and  
283 they are not agreeing on that, we also want them to pays us 20% of the income per  
284 quarter and they are not agreeing on that. They think they should not pay us anything  
285 because they are the proprietor. They are not even willing to pay for the running costs,  
286 electricity anything. So that paper is not wholly accepted. That's the problem for us.  
287 R: Why did you implement before you agreed on the terms?  
288 P: You see being the proprietor, we cannot refuse them. We thought that when it came  
289 to negotiations it will be very easy for us, but it didn't work out that way. Normally,  
290 you'd have to agree on terms before you start a business, but we allowed them to start  
291 and when they started to agree on certain things became a problem. Those two things  
292 I mentioned are serious problems. But anyway after three years you must allow the  
293 computers to become school property and you wash off your hands and they said no,  
294 we will do it as long as possible because this is our school. That problem is there. And  
295 then we asked them to pay us some money, initially it was 5%, but after looking at our  
296 expenditure, you see we pay the guards, two guards 5,000 per month, we pay  
297 electricity for the kitchen, the classrooms, the computer lab, it takes R700.00 a week.  
298 That's electricity. So we feel they should be part of that, but the agreement is not  
299 there.

300 R: You mean the electricity consumption has increased since computers came into the  
301 school or it has been like that all along?

302 P: No, it has been like that but they are also consuming part of electricity, so we think  
303 once they are using the electricity they should pay for that facility. They should  
304 contribute something towards. That's how it is.

305 R: Who would you say benefits the most from the use of computers?

306 P: The beneficiary becomes the student.

307 R: Would you say your management style has changed since computers came into the  
308 school?

309 P: No, we haven't changed so much. We are still expecting the computer company to  
310 succeed. Our aim is for the computer company to succeed as much as possible  
311 because we support the church program. You see the school is for the church and then  
312 government; I will put it that way, so we are working for both parties. Whoever  
313 established the company is our responsibility that it's a success. So our administration  
314 hasn't changed, if anything, we support the company. I will put it that way.

315 R: Your deputy also doesn't use the computer that much?

316 P: No, like I said he doesn't use one, we don't have a computer here. When teachers  
317 come we interview them, we show them how to their records of work, lesson notes  
318 like any teacher, any new teacher we try to help them; so in short our administration  
319 hasn't changed. We do what we are supposed to do and we do it for everybody.

320 R: What about the keeping of records by the secretary, has it improved since we used  
321 computers?

322 P: Oh yes, greatly! Before computers we were using type writers for.....keep  
323 records decently, even preparing quarterly accounts the computer just gives us the  
324 report very nicely; if the computer is not there you would get a lot of headache  
325 because the school is big. So the computer is helping to keep accurate records. It's  
326 easier and faster.

327 R: Any other thing you would like to mention?

328 P: Financially, it gives accurate records we used to write the reports manually and  
329 then go to type them at another computer.

330 R: So the mission had a computer before you?

331 P: Yes, long before us. So still we were using the computer to do our work but not as  
332 regular as this time. Now that we have it, it is everyday affair. That helps to keep  
333 accurate records; it helps the accountant to keep accurate records.

334 R: What achievements are evident generally since the use of computers?

335 P: Teachers have become curious on computer literacy. Other teachers who already  
336 know how to use computers are able to keep well records of students; academic work,  
337 so in one way or the other it has given more enlightenment, so to speak.

338 R: Are you intending to have internet connection soon?

339 P: Oh yes, that one, like I said the only is we don't have the ground-line. Maybe, we  
340 may have to use other means of establishing it.

341 R: Wireless connection?

342 P: Yes, exactly.

343 R: What challenges have you come across?

344 P: The only challenge is the company's cooperation. It has destabilised a little  
345 bit..... We have had a series of board meetings to solve this problem; it is not  
346 easy going. Otherwise we don't have any problem.

347 R: What do you intend to do to overcome this challenge?

348 P: No, we decide to keep it and they do what they want to do. But we know it is not  
349 the best because it may affect students' performance, which will show in two to three

350 years' time and by that time the harm has been done but there is nothing we can do  
351 because we tried to explain people will not cooperate so we leave it that way. It s not  
352 good for the consumer; it's not good for the students and the parents, but our hands  
353 are tied. When you fight authority too much it is not the best for the students.  
354 .....Maybe when the harm has been done then everybody will see  
355 it.....when the ministry realises that it is not been done properly then it can advocate  
356 for closing it and if that happens then the church will be aggrieved.

357 .....  
358 .....  
359 .....  
360 .....

361 R: Ok, we've come to the end of the interview, but do you have anything; final word  
362 or anything that I didn't ask you?

363 P: I'm glad; these things are hard. I'm encouraged because these things are good. It  
364 will help us also, you see we want the computer to be well done in the school; we  
365 want the school to be the best in the country, every area we want it to be properly  
366 done, so this meeting is a challenge for me to see to it that things may be better so that  
367 when another person comes with the same questions I may have better answers to his  
368 or her questions. I'm grateful.

**Appendix I: Principal C interview transcript**

**Principal C Interview transcript**

1 R: Do you have a need to use a computer on a regular basis?  
2 P: Definitely, that's how I feel. In my office or.....  
3 R: Anywhere you need to use a computer  
4 P: Students do need to use a computer in their computer-related subjects and also  
5 computer literacy and teachers also need to have the knowledge of that. I think the  
6 teachers and students are the ones to use the computer for academic work, but when it  
7 comes to administrative work, yes I do have the secretary who is dealing with that.  
8 R: That means you don't use it yourself?  
9 P: It is my wish but up to now I have not used it.  
10 R: So your secretary, what type of tasks does she do for you on a regular basis?  
11 P: Basically clerical work; my letters, computer filing, school records...  
12 R: How often does she use it?  
13 P: Almost everyday.  
14 R: How did she learn to use a computer?  
15 P: She started with the typing machine, so initially we were dealing with basically  
16 typing so she transferred those skills of typing to the computer; but for other functions  
17 computer teachers have to come to help her, teachers who are teaching computer here.  
18 She went to workshops, two workshops in Maseru with our partner, Bethel  
19 Consultants who we are sharing the computer training with.  
20 R: So you have a partner?  
21 P: We have a partner, yes. We had only one computer when we started three years  
22 ago. They brought all their computers into Form A. We started in Form A; we were to  
23 collect money and then take it to them before the end of the year.  
24 R: Where did you get the money from?  
25 P: From the students. We collected R100 from the students and ours was to build the  
26 lab and provide some other small things and provide security. We took that further;  
27 we bought our own computers before the end of the year. I think we bought about 15.  
28 R: They brought you computers?  
29 P: They brought us some computers and two teachers.  
30 R: But I have been told that there are three computer teachers.  
31 P: There are three computer teachers; two from Bethel and one paid by us.  
32 R: So you still have computers that are rented and the ones that are yours?  
33 P: Yes, presently we have 38. 38 from 50, they should be having something like 12.  
34 P: 38 are yours and 12 are Bethel's.  
35 R: Have you attended any training yourself?  
36 P: No, the secretary has. It is still my wish though.  
37 R: Do you have access to a computer at home?  
38 P: I have it, I have access to it, but I'm not using it.  
39 R: Who is using it?  
40 P: Basically my first son is using it. I bought it for him.  
41 R: When and why did your school start using computers?  
42 P: Three years ago, 2004 we started using in classrooms; two years prior to that, 2002,  
43 that's when we bought one for the office. Then we got into this big program now,  
44 bringing them into the classrooms.  
45 R: You don't have computers in the classrooms. Am I right? And why did your school  
46 decide to purchase computers?  
47 P: Well, we felt there is this current need for our students to have computer literacy  
48 and knowledge apply computers even in other subjects; the so-called normal subjects;  
49 English, Sesotho, language, mathematics. The application of that.....  
50 R: How many administration staff computers do you have?

51 P: We have only one.  
52 R: And for teaching staff?  
53 P: For teaching staff we have a computer in each department, though we have one in  
54 Maths/Science Department and one in the Arts Department. So I could say two. Some  
55 teachers, maybe I should add, go to the computer lab after classes if they have  
56 something to do. For setting questions and things like that, they go to the computer  
57 lab. They still have access to computers through the computer lab.  
58 R: So the learners are using the 50 in the computer lab?  
59 P: Yes  
60 R: How many computer peripherals are there at your school, that is, printers,  
61 scanners.....  
62 P: Printers we have three, two in the computer lab and one in here.  
63 R: Do you have any projector?  
64 P: We have one projector and a digital camera  
65 R: Do you have a TV?  
66 P: We have a TV, yes.  
67 R: Where is it located? I have not seen it in the computer lab  
68 P: Right now it is at my place, but we used to put it in the library; that's where it  
69 actually belongs.  
70 R: What aspects of hardware would you say enable or hinder the effective use of  
71 ICTs?  
72 P: I don't know whether I will be answering something that you haven't asked me.  
73 But my main worry here is, I don't have a problem with computers, the hardware or  
74 whatever we have, but I'm worried about the internet, we are not connected to the  
75 internet. That's a worry because I think students could gain more knowledge through  
76 the internet.  
77 R: So you have the experience of using the internet?  
78 P: Unfortunately we don't have it, but I know it is useful. I have asked friends to help  
79 me when I was writing my dissertation, so I depended on people to help me. I would  
80 go to NTTCC to ask people to show me; I'm not good at it. I know it is useful, but I  
81 will not go out and say I'm going to use the internet, I need somebody nearer to me to  
82 use it.  
83 R: Apart from the absence of the internet, would you say there is something else  
84 preventing you to use ICTs effectively?  
85 P: The printers as well as the computers, I think I'm satisfied. We have computers that  
86 can match the biggest stream; we have the biggest streams in Form B where we have  
87 in each stream around 50 students, so we have no problem with the number of  
88 computers. But the printers yes we have a problem, only two printers, I would say we  
89 need more.  
90 R: Why? Do you think students need to print at the same time?  
91 P: Particularly during the examinations, we experienced a problem when they wrote.  
92 Last year I saw a problem. At one point printers could not work, it was just a lot of  
93 work for them; they broke down; we need some more.  
94 R: But where I have seen a lot of computers, a hundred or more, at Rhodes where I  
95 am there is one printer for all users. But it's a big one.  
96 P: Maybe that's where we have a problem. Ours are not that big. They are very small.  
97 R: Maybe you need a stronger one. Are there separate computers for the junior and  
98 senior classes?  
99 P: No, they all use the same lab, they alternate.  
100 R: Do you have subject specific software?

101 P: I know they are there, we bought them, we have biology, language, one for  
102 mathematics. The only one, I'm told is being used is that one of biology, but even that  
103 one was not being used effectively.

104 R: So why do you think they are not being used?

105 P: I think it is the problem of attitude and probably teachers' understanding of a  
106 computer being a new thing to teachers. Teachers are still used to the old way of  
107 doing things.

108 R: So they are not willing to change or they are comfortable where they are.

109 P: Definitely I would think so. I know I have been urging, I couldn't buy more now  
110 because I know they are just there, they are filed, they are not being used.

111 R: Do teachers have access to computers any time they want to use them?

112 P: Yes they do, except when students are using them. But after classes they still go  
113 there and use them.

114 R: Are the computers all working?

115 P: Yes they are. Like I said we have this marriage with Bethel consults; even today  
116 the mechanic came to look at those which were not functioning well. So, on a regular  
117 basis they are being repaired. I wouldn't say even if we have the ones which are not  
118 functioning, it is for a short time. They come often to look at those.

119 R: So the Bethel group is the one responsible for maintenance? How regularly do they  
120 come?

121 P: It depends, sometimes we call them. When we are very busy on them like  
122 examination time they come almost every week. But at the beginning of a quarter like  
123 this they will come after a month or so, or when we call them.

124 R: So at the moment there are none that are not working? And these are the computers  
125 you bought three years ago?

126 P: Even this year we bought nine.

127 R: So every year you are buying?

128 P: Yes we are buying.

129 R: To replace the old ones or to increase the number?

130 P: Yes for the school particularly. We are intending to be on our own two years from  
131 now. Bethel is in Form B now, we have taken over in Form A and next year we will  
132 have taken over Form B and Form C like that.

133 R: Can you explain what you mean by taking over?

134 P: We have a contract with them. Initially, it was a three year contract, but we  
135 increased it by three years, so next year we will be in the fourth year

136 R: What do you mean you will be taking over? Can you explain this taking over?

137 P: Right now we are working in partnership, but after two or three years from now  
138 we'll be on our own, Bethel will be out.

139 R: What does Bethel do and what do you do as a school. I want to get it right.

140 P: Some of the computers we using are Bethel's, two teachers come from Bethel, the  
141 technician is Bethel's. So this that comes from Bethel will be ours.

142 R: Are you buying the computers from them?

143 P: We are buying through them.

144 R: So in three years' time all the computers will be yours?

145 P: Yes that's our aim.

146 R: What does the school give them (Bethel)?

147 P: There is the computer fee. For the classes they are taking; they are now in Form B  
148 and Form C, every student has to pay them R75.

149 R: Does all the money go to Bethel?

150 P: Yes all of it goes to Bethel, but practically students pay R100. That's what they

151 suggested anyway, R25 remains with the school for maintenance, for all these other  
152 small things.

153 R: Maybe, printing facilities?

154 P: Even some other things we are buying; mice or mouse. We bought some cables, but  
155 the big thing we did was to build the computer lab, and also to furnish it, the computer  
156 furniture; the stands.....

157 R: And the security.

158 P: Yes the security.

159 R: Other than the burglar door I've seen and also burglars on the windows, what other  
160 security measures have you put in place?

161 P: We have the security guard paid by the school, even though he does not basically  
162 work on computers, he takes rounds at night.

163 R: Has there been any tampering with the computers or the computer lab so far?

164 P: Yes, but it was not in the computer lab that time, but that time we had one  
165 computer in the library. Some parts were taken and we had to replace; I don't even  
166 remember whether they were replaceable. The present lab has never been tampered  
167 with.

168 R: Would you say you are satisfied with the maintenance and security that has been  
169 put in place?

170 P: Yes

171 R: Are the computers insured?

172 P: No, they are not

173 R: Wouldn't you say that is risky considering the high price of one computer?

174 P: It is, but the school doesn't have that kind of money, the insurance is expensive  
175 again for a small school like this.

176 R: If all of them would be taken in one night....?

177 P: Well we only hope; we would like to pray that it does not happen.

178 R: Do majority of teachers use computers with learners or by themselves?

179 P: No, not with learners. But I've got a group of teachers, particularly these young  
180 teachers who literally attend mini training from the computer teachers themselves.

181 R: So there is some training for teachers?

182 P: Yes, in fact this is what has been initiated by Bethel, our partners that one of the  
183 duties of their teachers is to train teachers, the members of staff; we don't pay for that  
184 and teachers don't pay for that.

185 R: Are you are aware of the training content or what they are being taught?

186 P: I have been there but not often; but what I have realised that like some members  
187 have been in institutions like the LCE(Lesotho College of Education) they are not at  
188 the same level, so many of them know what they want; they go in there and they want  
189 to learn specific programs. So its very hard even for teachers (computer teachers) to  
190 say we give you this; we are going to train you on this, teachers come with different  
191 needs. They just address what they need.

192 R: So there is no training program as such?

193 P: No, something like the syllabus, following the syllabus, no.

194 R: Would you say majority of teachers are using computers for their own  
195 administrative work?

196 P: Yah, an example is that two years ago, we stopped this two years ago, the questions  
197 were only typed by the secretary for all the members of staff, but I think only two or  
198 three now; basically the new ones, but even those ones we are urging them to go and  
199 train, have some computer skills, type questions for themselves. So, basically teachers  
200 are typing questions for themselves.

201 R: So the secretary is going to lose her job very soon?  
202 P: No, I think there are other things she is doing, but the load has come down.  
203 Teachers, like I said know what they want. Some other things like filing effectively  
204 like we need in the office; they don't go into those things, that is the area of the  
205 secretary. Teachers would basically need to know how to compile their questions,  
206 even file their own questions, but when it comes to a lot of work like the work that  
207 need to be filed in the office we still need the secretary for that.  
208 R: Do you think it is necessary to have continuous training in computers?  
209 P: Every machine today, you see a machine today and tomorrow a new thing has been  
210 put in, so I would wish to see ongoing training to keep up with the new developments.  
211 R: Would you say the training for teachers is adequate for their needs and the needs of  
212 their learners?  
213 P: As far as it meets the teachers' expectations I would say it is adequate.  
214 R: They have never said they are not getting enough from the computer teachers?  
215 P: I have never had a complaint from them.  
216 R: And for students?  
217 P: For students I'm not sure really because now we are being pushed by the  
218 examinations. Like I said students do the computer to write at the end of the course. It  
219 is examinable, we are using the NCDC syllabus.  
220 R: But that goes as far as Form C, what about the Ds and Es?  
221 P: Ds and Es is just literacy and application I think.  
222 R: They don't take any external examination?  
223 P: No, no external examination.  
224 R: You don't offer them the Cambridge examinations?  
225 P: No. We are however, arranging with Bethel if there could be some certificates that  
226 we offer, basically those would be the Bethel-Tsakholo High School Certificates of  
227 appreciation for computer literacy.  
228 R: Do you have any vision for ICT in the school?  
229 P: No, not written really. We would like to be the true members of the village, where  
230 we could be useful members of the village. I'm referring to the global village; hence  
231 the need to be connected to the outside world.  
232 R: What about the community around you?  
233 P: Yes we are already part of the community around us, since in a few years to come  
234 the learners will be in the village as adults, we are hoping that that's how we are going  
235 to contribute to the village; we will have people who are computer literate, probably  
236 they will pass that even to others.  
237 R: Are you involved with the community in anyway now in the use of computers?  
238 P: No, we tried it but we thought somehow it might be risky.  
239 R: What actually did you try?  
240 P: We wanted to bring them training; we wanted to open it to all members of the  
241 community to come for training; business men and some people who were willing.  
242 We realised that we could not open it up with the property like this; once we could  
243 have opened that everybody would come for training, so we felt it would be a little bit  
244 risky for all the members of the community to know exactly what we have and even  
245 know how to access what we have, so we have suspended for a while. Maybe we will  
246 come back to it.  
247 R: So you are still thinking of ways, maybe not getting everybody in, a few  
248 individuals you can trust?  
249 P: Maybe individuals we can trust, but its very difficult.  
250 R: But there would be the computer teacher with them, wouldn't there be?

251 P: Definitely, that one we are aware of, but there were individuals we felt we didn't  
252 want to see anywhere near any school property probably because of the school's  
253 relations with some of them so we felt we could not allow such people to come in  
254 because of the prevailing relationships then. But its our wish to involve the  
255 community.

256 R: Because I think they could assist the school by paying a small fee to use the  
257 computers, but I understand your concern.

258 P: Yah. There was a particular concern at that time.

259 R: Is there a written policy guiding the use of computers by members of staff and  
260 learners?

261 P: No, I don't want to tell a lie, it is not there.

262 R: Do you have a plan, like we want to do this and this during this session regarding  
263 ICT?

264 P: No, we don't. My understanding is that the policy, plan should be things which if  
265 you ask me I could be able to produce.

266 R: So you think it is not necessary?

267 P: I think it is necessary as you ask me, but up to now we have not thought about it.  
268 I'm here to meet a colleague in charge of that. The computers fall under Agric  
269 Department, I will ask the colleague to comment, most of the things we want them to  
270 come from the department and then we could see how we help in the administration,  
271 even other members of staff could see. We talk and discuss in the formal staff  
272 meetings

273 R: Do you have an annual budget for ICT equipment? You said there are things that  
274 you need to buy regularly like the mice, the cables.

275 P: Unfortunately I don't remember us budgeting for them. Most of the time we buy  
276 computers towards the end of the year with the remaining funds, we have never  
277 budgeted for them.

278 R: What if for some reason at the end of the year there are no remaining funds?

279 P: That would be hard luck; but our aim is to have bought 50 computers by the end of  
280 2008.

281 R: But you don't budget for it?

282 P: We don't budget for it. We already bought 38, 12 remaining is not much.

283 R: Why do you always have remaining money?

284 P: It is the nature of the school, the nature of the organisation so to say. When you  
285 start school with 500 students, yes you would budget on those and say 500 students  
286 should have paid this by the end of a quarter, but it is not always the case, sometimes  
287 you get school fees from only, say 30 students and 20 cannot pay, sometimes 10 have  
288 already left the school. So today its even worse, the students are there but they have  
289 no money. Many of them don't have parents; they lose parents almost everyday.

290 R: But then it means you must be having shortages at the end of the year if not all  
291 students pay their fees.

292 P: Yes. But again it depends on which things you are going to put focus on; if there  
293 are things which need a lot of money, like buildings, like last year we were engaged in  
294 a building; a lot of money was used on the building this year. At some point we have  
295 to pause and say we are no longer building now, we have asked the people who were  
296 building to go home for some months, then we will call them after, probably towards  
297 the end of the year. So we have stopped building. I hope you get my point. We keep  
298 on changing with the situation. The situation now demands that we have to stop a  
299 little bit..... So if at the end of the year we have money we say let us not use it

300 for the building, lets use it to buy computers because we do need these computers. So  
301 we go on bargaining like that; we don't have strict a strict budget, we change a lot.  
302 R: Who would you say benefits the most form the use of computers?  
303 P: I would put the learners.  
304 R: What achievements have you realised with the learners since the use of computers?  
305 P: The learners are the ones that are using the computer in compiling the articles in  
306 the newsletter. I take that as something that never happened before, normally it used  
307 to be the secretary or teachers who were doing it but they are doing it themselves,  
308 putting in the pictures and so on.  
309 R: I know you used to have the newsletter before the computers came.  
310 P: Yah that used to be the work of the secretary; now the students are able to do it.  
311 R: What achievements can you realise with teachers, well, the ones that are involved.  
312 P: Teachers, they were still doing what they are doing now but in a crude manner. I  
313 think the computers are making their work to be more efficient, more organised.  
314 R: Does it mean that if you were to ask for a test that was written two months ago you  
315 would get it easily?  
316 P: Yah easier than before. Sometimes it was problematic, the teacher would say I put  
317 it here and it is no longer there; now they can go and retrieve it from the computer.  
318 R: Would you say this has made your administrative work easier? Would it say it is  
319 better now?  
320 P: It is better now, initially dealing with the papers in the cabinets. This is what I have  
321 for last year's report and I have a copy of this, but I have been looking for this copy  
322 and it is not there. I went to the secretary to retrieve it and within 5 minutes it is out,  
323 so I think it is very helpful.  
324 R: What challenges have you come across in the implementation of ICTs in the  
325 school?  
326 P: School fees. We had to have computer fee above what the students were paying;  
327 that in itself was a very big challenge. Parents don't have money, particularly when it  
328 wasn't something optional; it was blanket that all parents should pay extra R100, it  
329 was not very easy to convince them, but I had a number of them (parents) who already  
330 understood what the computer entails, so they helped me. To make it easier for them,  
331 you see it is R400 payable in four quarters....There is a very big problem with the last  
332 quarter; the last quarter, you see for Form Cs, even for internal classes, but for Form  
333 Cs it is worse, they don't have the fourth quarter. They get into the fourth quarter for  
334 two days of teaching and then start writing the exams. So parents don't want to pay  
335 for the fourth quarter, and yet when you are in partnership like I am we have arranged  
336 with my partner that the fee should be R400. Its not very easy, the parent will say but  
337 my child is not being taught computer in the fourth quarter, so why should I pay?  
338 Then I ask, why should you pay school fees in the last quarter? They say that is  
339 different. But anyway, they now do understand.  
340 R: Any challenge with teachers?  
341 P: There is a challenge to have all teachers change their attitudes towards the  
342 computer. Having a positive attitude towards the computer; removing this fear that a  
343 computer is a difficult thing that you cannot deal with. We still got few teachers who  
344 are like that, particularly old teachers. I don't have big problems with new teachers,  
345 but old teachers we still got a problem; I'm one of those. You see, people who come  
346 from school and have worked hard, got their degrees not on computer and they come  
347 to teach, and they are paid on what they know, they are paid on leading the  
348 mathematics subject or languages or whatever without the computer and they are paid  
349 for that, for them its like asking them to go back to school. When you say do this on

350 the computer on that, they say we have done that at school. We can't go on learning,  
351 now we have to teach; we know mathematics and we can teach and students can pass  
352 without us using the computer.

353 R: Have you ever thought of what you can do to change their attitudes as their leader?

354 P: I have tried; sometimes I even use threats like this, teachers typing their own  
355 questions. I literally stopped my secretary from typing teachers' tests. I said no, don't  
356 do it, teachers will do it. Some of them, I must say, learned it the hard way because  
357 the secretary could not take their papers to type them. So I partly succeeded then. I  
358 asked a lecturer at the university, Mr. Ntlatlapa, Dr. Ntlatlapa to talk to them about the  
359 importance of using computers. He even suggested coming to give them basic training  
360 on computers, but you know they had to register; they had to pay a little fee for that. I  
361 must say not even a quarter of them paid, few paid, but the number was so little that  
362 he did not come.

363 R: But what majors do you think you can take to increase the interest of teachers.

364 P: I think it is just keeping on urging, praying, opening discussions on it, talking about  
365 it to understand their problems; finding out from them exactly what they want. Like  
366 some of them have started, I have said; they go into the computer room and tell the  
367 teacher that this is what I want to learn; I already have this. Basically, it is people who  
368 already got some idea.

369 R: How have you dealt with resistance to change in the past?

370 P: Resistance is almost all over; new things, English Speaking or English as a medium  
371 of instruction at school, I did have resistance at the beginning from some of my  
372 colleagues.

373 R: And how did you overcome this resistance of teachers?

374 P: I think it was through regular discussions; I couldn't punish teachers. I vowed that I  
375 should communicate in English with the teachers and students as well. I think that is  
376 what with computer one would need to do. I had started anyway; I had a computer in  
377 here, they took it some few months ago.

378 R: Why did they take it? Is it because you were not using it?

379 P: I was still using it, but not as much as I would love to. It was a shortage, anyway in  
380 the computer lab, so they came to ask for it.....I wanted to finish that; I wanted to  
381 finish that and then go back straight into the computer for office work. I had a lot of  
382 my personal work apart from office work.

383 R: But what do you think can work best? Talking to the teachers or showing interest  
384 yourself?

385 P: I'm the head teacher who is still their colleague and many of them know what they  
386 want. In higher institutions, computer literacy would be a prerequisite and many of  
387 them want to further their studies, they should take that as one of their needs.

388 R: Anything else that you may want to say apart from the questions that I have asked  
389 you?

390 P: I don't have much to say apart from complaining to even people who are not here. I  
391 said we are actually in the third year of the programme and the minister of education  
392 wasn't aware that there were schools which had started with computers and students  
393 who were writing that very year. He made a public speech in which he said he is  
394 asking for computers from the donors, NEPAD; the computers that you saw in some  
395 schools like Bereng; those are NEPAD computers, which were being brought to the  
396 very first schools (according to the minister) who were going to start computer  
397 literacy. So I was worried; I felt that the government is not very serious really. The  
398 bank gave us the office computers; and we must thank them for that; other than that  
399 we have been buying computers ourselves. I felt that the computers that NEPAD was

400 already giving out, could have been given to schools who had already shown interest  
401 in that, and we were one of those schools. And I have asked my colleagues in other  
402 schools, they got nothing. So, all the NEPAD computers were brought to schools  
403 which had not started; which have not shown interest. Maybe they have shown  
404 interest, but I don't know how; practically I couldn't see it. We sacrificed and we got  
405 nothing; we got no motivation from the government. I don't think it is fair and I don't  
406 think it will ultimately meet the expectations of even the government. I have been  
407 with some of the schools who were given the computers, in some schools it is a  
408 burden, they have been burdened with something that they were not prepared for and  
409 yet there were schools that were already prepared like ours. I have been fighting now  
410 for internet connection and I don't see it coming from one of the officials.

411 R: So you feel you are not getting enough support from the ministry?

412 P: I don't think the ministry is supportive enough. We are the ministry officials;  
413 people who are supposed to execute the ministry's policies. Last year the ECOL  
414 (Examinations Council Of Lesotho) registrar, almost towards the end of the year; it  
415 was around this time last year. You know at this time examination arrangements are  
416 being made; but around this time last year we didn't know whether our students were  
417 going to write Computer Education or not. The registrar herself said no, we cannot  
418 make an arrangement now; that is not there; it is probably something that could take  
419 place three years from now. We have been in a pilot group for three years. It was very  
420 late when the registrar started writing letters; I think it was around September. That  
421 was when even the questions were set. The officer in charge of the subject told us that  
422 no, the subject is going to be written, but the top official didn't know. Anyway, they  
423 wrote the exam.

424 R: How did they perform in the exam?

425 P: Badly. Fortunately, we had one teacher who went to mark the papers. He came  
426 back and said there was a lot of confusion at the marking; even the person who set the  
427 exam didn't know some of the answers to his questions. We couldn't agree on some  
428 of the answers he had put on the memo; he was also confused. We learned that, that's  
429 what the teacher said, he did not only set, he also moderated the questions. Morija  
430 Girls High School was number one in the country with one B and one C, and we had  
431 one C and so many students failed. We had 126 students, and around 60 passed. In  
432 other schools it was a disaster. Morija was not 50%, I think it was around 47%. So it  
433 was terrible.

434 R: Do you think now they are prepared?

435 P: They are. So let it be at least the fault of the teacher not doing the work not the fault  
436 that come from the top that we cannot correct. I still have a lot of work to bring  
437 together the schools if they will have interest, but I have got three principals who are  
438 interested in that meeting where we can come and probably write something strong to  
439 the examination council, how this (Computer Education) is being treated.

440 Thank you

## Appendix J: A summary of responses from computer teachers

### Summary of Responses: Computer Teachers

Theme	Enablers	Constraints
Experience <ul style="list-style-type: none"> <li>• Teachers</li> <li>• School</li> </ul>	<ul style="list-style-type: none"> <li>➤ 80% computer teachers have an experience of 5-6 years. Qu.2.1</li> <li>➤ School B and C have had computers for 3-4 years. Qu.3.3</li> </ul>	<ul style="list-style-type: none"> <li>➤ School A has been having computers for less than a year. Qu.3.3</li> <li>➤</li> </ul>
Training	<ul style="list-style-type: none"> <li>➤ Most popular mode of training is formal at a school (60%) followed by self-teaching and learning from colleagues (20% each). Qu.2.2</li> </ul>	
Access and Use <ul style="list-style-type: none"> <li>• Teachers</li> <li>• Learners</li> <li>• Community</li> </ul>	<ul style="list-style-type: none"> <li>➤ All computer teachers use computers for teaching learners Qu.2.5</li> <li>➤ Computer teacher in school A can use a number of different packages. Qu.2.8</li> <li>➤ All schools have computers for the different users i.e. admin, teachers and learners. Qu.3.1</li> <li>➤ School A has a computer in a media centre (formerly a library) where teachers can prepare lessons in their spare time</li> <li>➤ The no. of computers for learners in school A can support a 1:3 computer: learner ratio, school B a 1:2 and school C a 1:1 ratio. Qu.3.2</li> <li>➤ School A has computers in 4 different places – computer lab, staffroom, admin. office and media</li> </ul>	<ul style="list-style-type: none"> <li>➤ Only 40% use it for communication purposes. None of the computer teachers use computers for administration or entertainment purposes. Qu.2.5</li> <li>➤ Schools B and C have computers in 2 places only – computer lab and admin office. Qu.3.6</li> <li>➤ 60% of computer teachers have no access to computers at <u>home</u>. Qu.5.10</li> <li>➤ The community cannot access computers in all the schools. Qu.7.5</li> </ul>

	<p>centre. Qu.3.6</p> <ul style="list-style-type: none"> <li>➤ All computer teachers and other teachers can access computers anytime they want to. Qu.5.9, 5.12, 7.4. In school A they can even use the computers after school hours. Qu.7.5</li> <li>➤ 2 out of the 3 computer teachers in school C have computers at home. Qu.5.10</li> </ul>	
Peer support and collaboration	<ul style="list-style-type: none"> <li>➤ Give support to staff members. Qu.2.4</li> <li>➤ 80% are aware that teachers think computers are useful in teaching. Qu.2.6</li> <li>➤ Equip learners and teachers with ICT skills. Qu.2.4</li> </ul>	<ul style="list-style-type: none"> <li>➤ 40% computer teachers are aware that a <b>few teachers</b> use computers daily. Qu.2.6</li> <li>➤ 20% are unsure of the competence of teachers in computer use. Qu.2.6</li> </ul>
Maintenance and Security	<ul style="list-style-type: none"> <li>➤ 80% computer teachers can problem-solve computer problems themselves. Qu.2.7, Qu.6.3 (they apply some troubleshooting techniques)</li> <li>➤ All computers in school A are working. Qu.3.5</li> <li>➤ Schools B and C have computers in 2 places only - computer lab and admin office. Qu.3.6</li> <li>➤ All schools have at least 3 security measures in place - guard, burglar door and burglar on windows. Qu.6.5</li> <li>➤ Passwords and security lights are additions that appear in school B and C respectively. Qu.6.5</li> </ul>	<ul style="list-style-type: none"> <li>➤ 40% will ask a colleague or call an IT specialist when there is a problem. Qu.2.7</li> <li>➤ None of the computer teachers will consult help pages or ask a friend when there is a problem. Qu.2.7</li> <li>➤ Some computers in school B and C are not working. Qu.3.5</li> <li>➤ School A has computers in 4 different places - computer lab, staffroom, administration office and media centre. Qu.3.6 - risk of security</li> <li>➤ Shortage of printer cartridges in school A. Qu.3.9.</li> <li>➤ The computer technician is not based in schools, he is called when necessary. Qu.6.3</li> </ul>
Hardware <ul style="list-style-type: none"> <li>• Purchase</li> <li>• Devices</li> </ul>	<ul style="list-style-type: none"> <li>➤ School A got computers as a donation from the government.</li> </ul>	<ul style="list-style-type: none"> <li>➤ School B has 3 of the computer devices listed in Qu.3.7</li> <li>➤ School B has only one of the</li> </ul>

<ul style="list-style-type: none"> <li>• Peripherals</li> </ul>	<ul style="list-style-type: none"> <li>➤ School B has hired computers from a computer company</li> <li>➤ School C has both hired and bought computers. Qu.3.4</li> <li>➤ School A and C have 4 out of the 5 computer devices listed in Qu.3.7</li> <li>➤ School A and C have 3 out of the 5 peripherals listed in Qu.3.8</li> <li>➤ Floppy drives available in school A computers. Qu.3.9</li> <li>➤</li> </ul>	<ul style="list-style-type: none"> <li>peripherals listed in Qu.3.8</li> <li>➤ Scanners are not enough, no flash memory sticks in school A. Qu.3.9</li> <li>➤ There is no annual budget for purchase of hardware and software in schools A and C. Qu.7.1</li> <li>➤</li> </ul>
<p>Software</p> <ul style="list-style-type: none"> <li>• Operating systems</li> <li>• Application programs</li> <li>• Types</li> <li>• Subject-specificity</li> </ul>	<ul style="list-style-type: none"> <li>➤ School A and C have 3 different operating systems running on the computers including the oldest: windows 95. Qu.4.1</li> <li>➤ School A has the latest application programs running on all its computers –MSOffice 2003. Qu.4.2</li> <li>➤ School A has all the software types mentioned in Qu.4.3 installed in all its computers</li> <li>➤ 70% of the software types mentioned have been installed in the learners’ computers in school C. Qu.4.3</li> <li>➤ The subject-specific software in school A only covers 62.5% of subjects in the school curriculum. Qu.4.4</li> <li>➤ Although they have little or nothing in terms of subject-related software, they are satisfied with what they have. Qu.4.5</li> </ul>	<ul style="list-style-type: none"> <li>➤ There is only one operating system in school B – Windows XP. Qu.4.1</li> <li>➤ School B has only MSOffice 2000 programs. Qu.4.2</li> <li>➤ School C has a variety of application programs in its computers including MSOffice 98. Qu.4.2</li> <li>➤ Only 50% of the software types have been installed in learners’ computers in school B. Qu.4.3</li> <li>➤ Computer teachers in school B and C seem not to know the software types in teachers and Administration computers. Qu.4.3</li> <li>➤ School B and C have no subject-specific software. Qu.4.4</li> <li>➤ School A computer teacher is not satisfied with what is available. Qu.4.5</li> <li>➤ Absence of antivirus software is a problem in school C. Qu.4.6</li> </ul>
<p>Connectivity</p>	<ul style="list-style-type: none"> <li>➤ All users can access the internet in school A Qu.5.1</li> </ul>	<ul style="list-style-type: none"> <li>➤ No access to the internet in schools B and C. Qu.5.1</li> <li>➤</li> </ul>

	<ul style="list-style-type: none"> <li>➤ The internet connection is wireless. Qu.5.5</li> <li>➤ The computer teacher uses the internet on a daily basis. Qu.5.7</li> <li>➤ Can access the internet anytime he wants to. Qu.5.8, Qu.5.12</li> <li>➤ One computer teacher out of the two(in school C) with computers at home can connect to the internet at home. Qu.5.11</li> </ul>	
<p>Institutional Planning and Support</p> <ul style="list-style-type: none"> <li>• Budget</li> <li>• Training Plan</li> <li>• Computer Levy</li> </ul>	<ul style="list-style-type: none"> <li>➤ There is an ICT training plan for teachers in school A. Qu.7.2</li> <li>➤ There is a computer levy for learners in schools B and C. Qu.7.7</li> <li>➤ All ICT expenses are paid by the donor (Oracle Consortium) in school A. Qu.7.8, 7.10.</li> <li>➤ In school B and C the school pays for electricity and printing expenses. Qu.7.8</li> <li>➤ There is a positive attitude of all stakeholders for ICT facilities in school A Qu.7.10</li> </ul>	<ul style="list-style-type: none"> <li>➤ There is no annual budget for purchase of hardware and software in schools A and C. Qu.7.1</li> <li>➤ There is also no annual budget and plan for the training of teachers. Qu.7.2 &amp; 7.3</li> <li>➤ There is no computer levy for learners in school A.</li> <li>➤ There is no insurance for the ICT equipment in all schools. Qu.7.8.</li> </ul>

## Appendix K: A summary of responses from teachers

### Summary of responses: Teachers

Factors	Enablers	Constraints
<p>Access to hardware (including peripherals), software</p> <ul style="list-style-type: none"> <li>• At work               <ul style="list-style-type: none"> <li>○ Teachers</li> <li>○ Learners</li> </ul> </li> </ul>	<p>9. Presence of computers in school(3) Qu.3.4, Qu.5.9, Qu.7.8, Qu.8.2</p> <p>20. Adequate number of computers – Qu.5.9</p> <p>33. Presence of peripherals such as printer, projector, scanners at school- Qu.7.8, Qu.8.2</p> <p>12. Access – all teachers have access to computers at school – Qu.4.1, Qu.4.5, Qu.6.2</p> <p>16. Access to computers 24hrs Qu.4.9, Qu.6.4, Qu.7.8</p> <p>26. All learners have access to computers in all the schools – Qu.7.3</p> <p>27. Learners in school A can use computers even after school hours (In school B and C the responses are different). Qu.7.5</p>	<p>16. Teachers cannot access computers after school hours in school B – Qu.6.5, Qu.6.6</p>
<p>Access to hardware</p> <ul style="list-style-type: none"> <li>• At home</li> </ul>	<p>14. Use of computers at home for teaching preparation and administration purposes Qu.4.4</p>	<p>13. Access to computers at home – 50% of the teachers have computers at home – Qu.4.3B</p>
<p>Access to the Internet</p> <ul style="list-style-type: none"> <li>• At work</li> </ul>	<p>15. All teachers have access to the internet in school A – Qu.4.7, Qu.8.1</p>	<p>4. No access to the internet in schools B and C (3) – Qu.3.4, Qu.4.9, Qu.5.9, Qu.7.8, Qu.8.3</p> <p>8. No landline telephone – Qu.4.9</p>
<p>Access to the Internet</p> <ul style="list-style-type: none"> <li>• At home</li> </ul>	<p>?</p>	<p>?</p>
<p>Experience of teachers</p> <ul style="list-style-type: none"> <li>• Teaching</li> <li>• Computer Use</li> </ul>	<p>3. Teaching experience – 75% of teachers have taught for 0-10yrs – Qu.1.8</p> <p>5. Previous experience – Most of the participants are young teachers who have been <b>exposed</b> to computer use in colleges and universities – Qu.3.1, Qu.3.2, Qu.3.4</p> <p>11. Long experience with computer use</p>	

	-10yrs+ -Qu.3.4 4. Variety of uses – teachers seem to be using the computer for a variety of tasks, although occasionally – Qu.2	
Curriculum integration <ul style="list-style-type: none"> <li>• Resources</li> <li>• Attitudes</li> </ul>	32. Presence of spreadsheet program, word processor assist in subject-specific uses – Qu.7.8, Qu.8.2 34. Available software such as encyclopaedia and subject content for learners Qu.8.2 28. All schools seem to have end of level objectives for learners – Qu.7.6 35. Teachers have a positive attitude towards inclusion of ICT in the curriculum, use in teaching and subject integration – Qu.8.4 30. Learners are eager to learn, have interest, are attentive in computer lab (5) - Qu.7.8, Qu.8.1 17. Available curriculum Qu.5.1	13. No integration of ICT into teaching(2) – Qu.5.9 15. Some teachers are not interested in computers – Qu.6.2 9. There is no appropriate subject software – Qu.4.9 1. Frequency of use – most teachers are occasional computer users on professional tasks(Qu.2); frequency of use increases with non professional tasks- Qu.3.3, Qu.4.1 6. Internet <b>occasionally</b> used for teaching purposes Qu.4.7
Learner skill <ul style="list-style-type: none"> <li>• Prior exposure</li> <li>• Present skills??</li> </ul>	24. In all schools there is some learners who acquired computer skills before introduction of computers in their school – Qu.7.1 25. Learners with prior exposure to computers are better users – Qu.7.2	20. Learners with prior exposure tend to explore non-academic things during class time and fail to take instructions – Qu.7.2 22. Learners lack of internet knowledge and skills delay teaching Qu.7.8
Institutional support <ul style="list-style-type: none"> <li>• Managerial <ul style="list-style-type: none"> <li>○ Vision</li> <li>○ Policy</li> <li>○ T. Plan</li> <li>○ Budget</li> <li>○ Timetable</li> </ul> </li> <li>• Technical</li> <li>• Peer</li> </ul>	29. Majority of teachers seem to know who troubleshoots learners' computer problems – Qu.7.7 31. The principal giving a lot of support all the time in school A – Qu.7.8 7. Assistance that teachers get from the computer teacher and other teachers is adequate (5)- Qu.3.4, Qu.5.9, Qu.6.6, Qu.7.8 23. Principal in school A reports back to whole staff after ICT training. 22. Principal in school A is a frequent computer user (uses computer everyday as stated in interview – line 8)– Qu.6.7	19. No report on ICT achievements to other tchrs to check progress because no vision, plan–Qu.6.10 11. No ICT training plan and budget in schools Qu.5.5, Qu.5.9 7. No school policy on accessibility for use in teaching – Qu.4.9 5. No <b>cross-curricular use of ICT policy</b> in schools- Qu.3.4, Qu.4.6, Qu.5.7 2. No provision for teachers to use computers with learners on the timetable - clashes on the timetable – Qu.3.4, Qu.4.6 17. Principals in the two schools(B and C) do not use computers- Qu.6.7

<p>Training</p> <ul style="list-style-type: none"> <li>• Teachers</li> <li>• Principal</li> </ul>	<p>6. Self-teaching on the job ranks highest as a mode of computer skills acquisition – <b>triggered by previous exposure to computers in colleges?</b> – (relate to access)Qu.3.1</p> <p>19. In-service training provided Qu.5.9</p> <p>8. Self-teaching during studies Qu.3.4</p> <p>10. Did Computer studies Qu.3.4</p>	<p>21. Teachers lack pedagogical competencies compatible with ICT approaches – Qu.7.8, Qu.8.3</p> <p>24. It is not easy to ‘interpret’(<b>integrate</b>) ICT into teaching – Qu.8.3</p> <p>23. Trying to use new programs is always a hassle, <b>so some teachers may shy away from computer use</b> (the bolded text is my addition) – Qu.8.3</p> <p>18. No ICT training for principals in school B and C – Qu.6.8</p> <p>10. Minimal or no ICT-related training at schools Qu.5.2</p>
<p>Leadership and Decision-Making</p>	<p>18. Decision on type of training made by teachers and the computer teacher Qu.5.6</p> <p>21. The principal and computer teacher make decisions on hardware and software purchases for everybody – Qu.6.1</p>	<p>12. Decision on type of training made by teachers and computer teacher Qu.5.6</p> <p>14. The principal and computer teacher make decisions on hardware and software purchases for everybody - Qu.6.1</p>

## Appendix L: A summary of responses from principals

### Summary of responses: Principals

Themes	Enabling factors	Constraining factors
<p>Computer Introduction and Use</p> <ul style="list-style-type: none"> <li>• Need</li> <li>• Purpose</li> <li>• Frequency</li> </ul>	<ul style="list-style-type: none"> <li>➤ All principals definitely see a need to use computers. Qu.1</li> <li>➤ Principal in school A uses the computer both for administration purposes and for teaching. Qu.2, mm.A1</li> <li>➤ Principal A uses the computer everyday</li> <li>➤ Secretary in school C uses the computer frequently Qu.3</li> <li>➤ All schools introduced computers so that learners are literate. Qu.7</li> <li>➤ School B also had them for administration and competition in the job market purposes.Qu.7</li> <li>➤ School C is the only school that has subject application purpose for introduction Qu.7</li> <li>➤ Majority of teachers in school C do their admin work on computers.mm 1</li> </ul>	<ul style="list-style-type: none"> <li>➤ Two (B and C) of the principals, however do not use the computers themselves. Qu.2</li> <li>➤ Secretary in school B uses the computer when need arises Qu.3</li> <li>➤ Few teachers in school A and B use computers.mm2</li> <li>➤ No teachers use computers with learners in school B and C (one). mm2</li> <li>➤ School A teachers use computers for non-academic stuff eg. Pornography. mm2</li> </ul>
<p>Experience and Training</p> <ul style="list-style-type: none"> <li>• Principal</li> <li>• School</li> <li>• Secretary</li> <li>• Teachers</li> </ul>	<ul style="list-style-type: none"> <li>➤ Principal A has an experience of 9 yrs with computers. Qu.4</li> <li>➤ School B and C have 4 years experience. Qu.4</li> <li>➤ School A principal attended a 2-3mth course and a NEPAD one-week training course. Qu.5</li> <li>➤ Secretary in school B has a formal computer literacy qualification.</li> <li>➤ Secretary in school C attended a training course. She also has an in-house training from the computer teachers.Qu.5</li> <li>➤ There has been formal and informal training of teachers in school A and its continuing.</li> <li>➤ Teachers in the 'ICT committee'</li> </ul>	<ul style="list-style-type: none"> <li>➤ School A has less than 1 year experience.Qu.4</li> <li>➤ There has not been any formal training for school B and C principals.</li> <li>➤ In school C there is continuing informal training of teachers Qu.20</li> <li>➤ There has never been any teacher training in school B Qu.20</li> </ul>

	<p>have planned a one-to-one coaching of teachers in school A. Qu.20</p> <ul style="list-style-type: none"> <li>➤ All principals agree that there should be continuing teacher training to update, refresh or improve acquired knowledge and skills. Qu.21</li> </ul>	
<p>Access to hardware, software, Internet</p> <ul style="list-style-type: none"> <li>• School</li> <li>• Home</li> <li>• After school</li> <li>• Community</li> </ul>	<ul style="list-style-type: none"> <li>➤ Principal C has a computer at home Qu.6</li> <li>➤ Teachers in school A and C have access to computers all the time; even after school hours Qu.12, mm1</li> <li>➤ Teachers in school B can access the office computer all the time Qu.12</li> <li>➤ A few members of the community (e.g. teachers' children and others in school A) is allowed to use school computers in the lab after school hours although not yet formalised Qu.12</li> <li>➤ Internet can be accessed by all in school A. mm1</li> </ul>	<ul style="list-style-type: none"> <li>➤ Principal A and B have no computers at home. Qu.6</li> <li>➤ Principal C does not use the available computer at home Qu.6</li> <li>➤ 15 teachers have to share one computer in schools A and C in staffroom. Qu.8</li> <li>➤ School C has suspended for a while the involvement of the community (Qu.13)</li> </ul>
<p>Available ICT infrastructure</p> <ul style="list-style-type: none"> <li>• Hardware</li> <li>• Software</li> <li>• Peripherals</li> <li>• Internet</li> </ul>	<ul style="list-style-type: none"> <li>➤ School A has the highest number(5) printers and other peripherals Qu.10</li> <li>➤ School A and C have data projectors. In addition, school A has a scanner, while school C has a digital camera Qu.10</li> <li>➤ The computer to learner ratio is 1:3, 1:2, 1:1 in schools A, B and C respectively. Qu.8</li> <li>➤ There is wireless internet connection in school A. mm1</li> <li>➤ Adequate no. of peripherals in school C</li> </ul>	<ul style="list-style-type: none"> <li>➤ School A is not satisfied with the peripherals it has eg. Scanners Qu.10, mm2</li> <li>➤ School B has the lowest number of printers(2) and none of the other peripherals Qu.10</li> <li>➤ Printers break down during heavy printing in exam in school C. mm2</li> <li>➤ Computers not networked in all schools mm2</li> </ul>
<p>Curriculum integration</p> <ul style="list-style-type: none"> <li>• Resources</li> <li>• Admin use</li> <li>• Subject use</li> <li>• Extended use</li> </ul>	<ul style="list-style-type: none"> <li>➤ Two of the schools (A and C) have subject-specific software although not all subjects are covered. Qu.11</li> <li>➤ Several teachers in school C use the computers for their own administrative work. Qu.18, mm1</li> <li>➤ In school A there is subject</li> </ul>	<ul style="list-style-type: none"> <li>➤ School B has no subject-related software. Principal thinks that is another level of development they are not ready for yet. Qu.11</li> <li>➤ In school C the available software is not being used effectively, some is not used</li> </ul>

	<p>content for several subjects in the curriculum. Qu.19, mm1</p> <ul style="list-style-type: none"> <li>➤ There is a curriculum for computer teachers in school B and C as a guide Qu.19, mm1</li> <li>➤ School C also has subject-specific software for teachers (3 subjects).Qu.19</li> <li>➤ Learners in school C can use computer to compile school newsletter articles. mm1</li> </ul>	<p>at all. Qu.11</p> <ul style="list-style-type: none"> <li>➤ Few teachers in school A use computers with learners. Qu.18</li> <li>➤ Teachers in school B visit the computer lab to make themselves computer literate Qu.18</li> </ul>
<p>Institutional Support</p> <ul style="list-style-type: none"> <li>• Managerial</li> <li>• Peer</li> <li>• technical</li> </ul>	<ul style="list-style-type: none"> <li>➤ The computer teacher is always available for anybody who wants to use the computer lab. Qu.12, mm1</li> <li>➤ All computers are working in all the schools – efficient technical support?? Qu.13</li> <li>➤ The computer teacher in school A has some technical know-how.Qu.14</li> <li>➤ Technical check-ups in school A and C are scheduled Qu.15</li> <li>➤ In school B and C technicians come immediately and often respectively when necessary Qu.15</li> <li>➤ All principals are aware of the training that teachers have undergone or presently doing Qu.22</li> <li>➤ Principal C commented that teachers are getting adequate training from computer teachers Qu.23</li> <li>➤ School A has an ICT budget included in the technical department budget. Qu.26</li> </ul>	<ul style="list-style-type: none"> <li>➤ The administration has no control on the computer lab in school B.Qu.12</li> <li>➤ A special arrangement has been made for only certain classes (Form A and Bs) to use computers after school hours. Qu.12</li> <li>➤ All schools rely on off-site help for serious technical problems.Qu.14</li> <li>➤ Technical support in school A is usually delayed because it can only be done during the scheduled visits Qu.15, mm2</li> <li>➤ Principal A is aware that the subject content supplied by Oracle is not complete; needs supplementation. Qu.23</li> <li>➤ No ICT vision, policy or plan in all the schools. Qu.25</li> <li>➤ Few computers for teachers in school A and C and no computers for teachers in school B mm2</li> <li>➤ No budgeting is done in school C because fee payment is unpredictable mm2</li> </ul>
<p>Security</p>	<ul style="list-style-type: none"> <li>➤ All schools have security guards, burglar proofing and electricity as security measures.Qu.16</li> <li>➤ School A additionally has locks and alarms. Qu.16</li> <li>➤ Principals B and C are satisfied with the security measures that have been put in place.Qu.17</li> </ul>	<ul style="list-style-type: none"> <li>➤ Principal A is not satisfied with what he has in place, he thinks they can improve by employing fully qualified security guards Qu.17</li> <li>➤ Computers not insured mm2</li> </ul>

<p>Attitude</p> <ul style="list-style-type: none"> <li>• Teacher</li> <li>• Learners</li> </ul>	<ul style="list-style-type: none"> <li>➤ Learners very interested in learning use of computers in school A mm2</li> <li>➤ Learners are demonstrating interest by application of learned skills in an extracurricular activity mm1</li> </ul>	<ul style="list-style-type: none"> <li>➤ Teachers lack passion and interest in computers in school A. mm2</li> <li>➤ Teachers do not make an effort to prepare for use with learners. mm2</li> <li>➤ Teachers cannot operate some of the equipment and fear asking for help in school A and C mm2</li> <li>➤ Teachers tend to focus on non-academic use of computers such as pornography. mm2</li> <li>➤ Old teachers including principal in school C fear new technology mm2</li> <li>➤ Teachers are resisting change in school C mm2</li> <li>➤</li> </ul>
<p>External Support</p> <ul style="list-style-type: none"> <li>• MoE</li> <li>• Parents</li> </ul>	<ul style="list-style-type: none"> <li>➤ Parents were involved in the decision to bring computers into school in school A and C mm2</li> <li>➤ Some parents who were aware of computers assisted principal in convincing others of usefulness of computers in school C mm2</li> </ul>	<ul style="list-style-type: none"> <li>➤ MoE does not support the school's computer initiative mm2</li> <li>➤ The examining body was ill-prepared for the first Computer Education Exam mm2</li> <li>➤ Parents did not want to pay 4<sup>th</sup> quarter fee (R100) cause it is shorter mm2</li> <li>➤</li> </ul>

KEY:

Mm1 = mind map 1 = enabling factors in implementation

Mm2 = mind map 2 = Challenges/constraining factors in ICT