THE USE OF COMPUTERS AMONG SECONDARY SCHOOL EDUCATORS IN THE WESTERN CAPE CENTRAL METROPOLE

Visvanathan Naicker

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Supervisor: Professor Louis C H Fourie

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DECLARATION

I declare that *The use of computers among secondary school educators in the Western Cape central metropole is* my own work, that it has not been submitted for any degree or examination in any other university, and that all the sources I have used or quoted have been indicated and acknowledged by complete references.

Visvanathan Naicker **June 2010**

Signed………………

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ABSTRACT

Background: The use of computers in the classroom could allow both educators and learners to achieve new capabilities. There are underlying factors, however, that are obstructing the adoption rate of computer use for instructional purposes in schools. The study focused on these problems with a view to determining which critical success factors promote a higher adoption rate of computer usage in education. This study derived its theoretical framework from various technology adoption and educational models. Furthermore, it investigated ways in which computer technology could enhance learning.

Methodology: The nature of the study required a mixed methods approach to be employed, making use of both quantitative and qualitative data. Two questionnaires, one for the educators and one for the principals of the schools were hand-delivered to 60 secondary schools. Exploratory factor analysis and various internal consistency measures were used to assess and analyse the data.

Results: The analyses of the data indicated that educator pedagogies were the highest predictors on the use of computers in the classroom. Although the quantitative analyses for educator support, training and attitude were the lowest predictors on the use of computers, the qualitative analysis, nevertheless, found sufficient support for it. Furthermore, significant age differences in the use of computers were also found. The results also suggest that educator training colleges should amend their teaching programs to include increased use of computers and how it should be used in the classrooms to teach. Principals of schools are adamant that although computer hardware and software are essential pre-requisites for effective and efficient use of computers - they state that the skill and attitude of the educator ultimately determines the increased use of computers in their schools.

Conclusion: Educationists and policy-makers must include all principals and educators when technological innovations are introduced into schools. All these role-players need to be cognisant of the implications if innovations are not appropriately implemented. Including the use of computers in educator training programs is important so that pre-service educators can see the benefits of using the computer in their own teaching.

Educator pedagogy, theories and beliefs and access to computers were the highest predictors of using computers, hence a model was developed. The model aims to strengthen the educators' initiatives to increase the likelihood that would result in enhanced teaching and learning when using computers.

Key Words: computers, educator attitude, educator pedagogy, educator support, educator-computer access, educator theories and beliefs, secondary schools, educator-computer training, adoption.

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LIST OF ACRONYMS AND ABBREVIATIONS

ANOVA	Analysis of Variance
BECTA	British Educational Communications and Technology Agency
BESA	British Educational Suppliers Association
CFA	Confirmatory Factor Analysis
CFI	Comparative Fit Index
CFT	Computers for Teachers
DF	Degrees of Freedom
EFA	Exploratory Factor Analysis
ICT	Information Communication and Technology
KMO	Kaiser Meyer Olkin
NEPI	National Education Policy Investigation
NFI	Normal Fit Index
NOF	New Opportunities Fund
OBE	Outcomes Based Education
OECD	Organisation for Economic Co-Operation and Development
RML	Robust Maximum Likelihood
RMSEA	Root Mean Square Error of Approximation
SACE	South African Council of Educators
SAS	Statistical Analysis Software
SADoE	South African Department of Education
SPSS	Statistical Package for Social Sciences
SRMR	Standardised Root Mean Square
WCED	Western Cape Education Department

CHAPTER 1

INTRODUCTION AND BACKGROUND

1.1 Introduction

The use of computers for teaching purposes continues to create pedagogical and didactic problems in South Africa (Hodgkinson-Williams, 2005). During the last seven years (2001-2008), the provincial government of the Western Cape has provided core funding for the Khanya project, amounting currently to R104 million; while donor organisations and corporate sponsors have donated another R20 million to bring computers into schools (Khanya, 2006). A large portion of the allocation went to the improvement of the existing infrastructure and the procurement of hardware and software.

The hope that a substantial disbursement of funds would lead to a change in the way educators teach has not yet been fully realised (Miller, Van Belle, Naidoo and Chigona, 2006). The Department of Education (DoE) policy document stipulates that: "Every South African learner will be Information and Communication Technology (ICT) capable by 2013" (DoE 2003, p.17). Although technology, on its own, will not change the teaching and learning processes, computer use and the acquisition of computer skills should be able to assist learners and educators to improve them (Infodev, 2005).

The Department of Education (2003), furthermore, believes that computers will be able to improve on how educators teach and learners learn.

Based on this argument, the DoE (2003) is of the opinion that learners and educators will be able to function across three dimensions. Firstly, there is the 'operational dimension', which refers to skills when using computers. Secondly, there is the 'cultural dimension', which concerns the support for computer use and practices related thereto.

Finally, at the third level, there is the 'critical dimension'. This tests the ability of educators and learners to challenge the assumptions regarding the successful use of computers in teaching and learning.

In their seminal work 'Information and Communication Technologies in South African Secondary Schools', Howie, Muller and Paterson (2005) argue that computer use will provide learners with the opportunity to learn ICT skills that will be valuable in a technology-saturated work environment.

Howie and others (2005) assert that the integration of computer use across the curriculum should be able to support learners in becoming creators of knowledge. For example, by surfing the internet for information related to their projects, tasks, or assignments, learners are simultaneously sharpening their research skills. They state that educators have to fulfil a pivotal role in ensuring that teaching and learning be geared to equip learners adequately for an information-overloaded environment (Howie *et al*., 2005).

Evidence from the literature surveyed shows that mobilising educators to use computers in their teaching is a slow and tedious process. Those who use computers can participate in the information society, by resorting to enquiry-based learning and developing higher-level thinking skills (DoE, 2003). The realisation of DoE policy goals thus requires the integration of computers in teaching and learning. Therefore, the use of computers in teaching and learning is to be strongly encouraged.

According to Castells (1999), computer usage is a basic requirement for an information society for which schools must prepare their students. The White Paper on e-Education states that using computers for teaching adds value to education, improves teaching and learning, encourages innovation and, in addition, contributes to transformation (DoE, 2003). However, what is not very clear from the above-mentioned White Paper is how these arguments can be applied in classrooms - or in which way the use of computers can support teaching and learning. Currently, uncertainty exists as to why there is such a low level of computer use in Western Cape schools.

Isaacs (2007) asserts that more attention must be given to the use of computers in education to enable quality learning and teaching to take place and also to improve the performance of all learners in schools.

According to Cawthera (2000), there is more to ICT interventions than merely technology. There are factors, he argues, that will accelerate or impede an educator's use of technology. Burger, Deutschmann and Waymark (2003) are of the opinion that the implementation of computers and the responsibility for this lies with the educators. They argue that educators have the power to decide when to use computers to improve the dissemination of knowledge to their learners.

The World Bank report (World Bank, 1988) clearly stipulates that no country can afford to ignore the need to include computers in its education system. Furthermore, information elucidated from the report indicated that many countries are investing in computer use without any clear plans and objectives for how they will be implemented. Therefore, there seems to be an urgent need to develop ways to make computer use and the realisation of educational goals easier to measure - a task that could surely be facilitated by computer technology.

With the shortage of educators and the huge dropout of learners in South Africa, a radical approach to propel our educational system forward is urgently required. This is achievable through the widespread application of computer use (Dugmore, 2004). Learners need to understand that when they enter the real world, they will need to be productive. They must be able to use computers to produce new intellectual and creative work that will add value to society. More importantly, they will require computer skills to provide and communicate new knowledge.

Educators and learners require these skills for the 21st century, and according to Alvin Toffler (1970, p.146), "the illiterate of the 21st century are not those who cannot read and write, but those who cannot learn, un-learn and re-learn." Educators must be prepared to educate their learners and be able to stay abreast of the constantly changing technology - since many jobs now, and in the future, will involve technology.

When compared to modern business, Heydenrych and Cloete (2007, p.324) exhort that, "all too often the impact of a new technology is overlooked if a business cannot adapt fast enough to take full advantage of first moves".

It is therefore necessary to prepare learners for a productive life in the information society, where the computer skills of learners and educators will continue to be a priority.

This research is an attempt to learn more about the use of computers by secondary school educators for teaching purposes. Chapter 1 addresses the background to the research problem, the actual problem identified, objectives, their significance and the assumptions of the research. Furthermore, it highlights the research questions, the conceptual framework and the methods of research.

1.2 Background

The Western Cape Education Department - and particularly a previous Minister of Education, Mr Cameron Dugmore - have taken an interest in exploring the introduction of qualification requirements for school business management in the Western Cape. The Western Cape education minister was convinced that essential school management skills and competencies would assist South Africa in developing and improving its educational processes. He accordingly committed his department to the delivery of pilot programs in late 2008 (Dugmore, 2004).

Effective school management will have an indirect impact on educational quality by emphasising the effective use of computers. The use of computers again can have a direct impact on the quality of teaching and learning (Martin, Madinarch, Kanaya and Culp, 2004; Jung, 2005).

The slow pace of policy implementation and the lack of ICT resources in many schools create imbalances in the education system. Therefore, the use of newer technologies and systems will encourage the Western Cape Education Department to engage in more competitive school projects (Miller *et al*., 2006a).

One such project, the introduction of Outcomes-Based Education into South African schools, seems to have actually slowed the pace at which computers are being used in classrooms (Fakier and Waghid, 2005; Donnelly, 2007; Janson, 1997). After the 1994 elections, the educational system was reformed - resulting in an Outcomes-Based Education (OBE) policy.

Due to numerous problems with the new OBE system, there have been increasing demands from society for changes to meet the expectations of learners, educators and the public in general (Malan, 2000; Janson,1997).

1.3 Rationale

This study will endeavour to determine the status of computer usage by educators for teaching and learning purposes. It will also establish why the use of computers for teaching purposes is still at a relatively low level in many schools, especially after the Western Cape Education Department had implemented the Khanya Project. With the present 'brain drain' of skilled educationalists - as well as the attrition within the profession - it has become important to explore alternative methods of teaching.

The Khanya project was an initiative to provide schools in the Western Cape with computer laboratories. This project, initiated in April 2001 by the Western Cape Education Department, now extends to 85% of all schools in the Western Cape. The Department provided these schools with computer laboratories consisting of networked computers. They were also supplied with software programs, computer training and internet connections to support both educators and learners (Khanya, 2006).

The intention of the Department was to support learners and encourage educators to use computers in their instruction, especially those learners coming from disadvantaged backgrounds. The skills output, however, proved to be disappointing (Govender, 2008).

The question then arises whether schools should continue with "business as usual" - using the traditional 'chalk and board' method and paying less attention to the use of computers. It may be argued that a properly functioning education system with innovative leadership from educationists and school leaders is necessary in order to minimise the effects of computer-illiterate educators. The alert school principal is mindful of the multiplicity of factors that affect teaching and learning and therefore s/he must initiate a response to the use of innovative technology in schools.

This study must therefore seek to capacitate secondary school educators on how to improve the quality of teaching and learning - by including the use of computers in their teaching - whilst simultaneously responding directly to the challenges created by the use of computers in secondary schools.

1.4 Theoretical framework

The nature of this research requires an intensive study of the literature in order to produce an effective implementation strategy for effective secondary school educators to harness the use of computers in their teaching pedagogies. As a result, the literature study was based on a conceptual framework that focused on two main areas: (1) technological developments in teaching and learning, and (2) factors affecting the use of computers in secondary schools.

Technology models, school ICT policies and critical educational pedagogies provided the theoretical underpinnings. Many research findings concluded that the use of computers in education was an efficient and effective method of lesson delivery (Miller *et al*., 2006a; Jones 2004; Whale, 2006; Cox and Rhodes, 1998).

Advancements in technological innovation in education have, unfortunately, created many challenges for educators. To add to their problems, even more advanced levels of computer technology are constantly being developed. A review of the literature has revealed that there are only a limited number of studies that have been conducted on computer-use for teaching purposes, and that there is a dearth of information regarding educators' use of computers in their lessons.

According to Johansen (1999), UNESCO endorsed the use of computers in education and is committed to assisting developing countries in their efforts to achieve this. He is of the opinion that every child has the right to be educated, and that computers should play an integral role in achieving this. In order to compete effectively in the global marketplace, the competitiveness of any economy depends on its efficient use of computer technology (Lundall and Howell, 2000). Furthermore, they argue that the ability of any government to deliver on its social needs is facilitated by the efficient use of computer technology.

This is further supported by Evans (2003, p.525) who believed that “employers are looking for potential employees who display a combination of knowledge, skills and attributes like agility, innovation and leadership.” In this context, the use of computers in education can be seen as a solution to help prepare citizens for the information era. But this, of course, is not happening fast enough.

A study by Schiller (2003) conducted in Australia, reported that more research should be done to understand why the full potential of computers for teaching purposes is not being developed. Inertia on the part of educators – also, possibly, because they are so busy that they do not have time to master their own computer skills. So, they take the easiest way out: they do not teach their learners how to use computers. In a similar vein, Lim and Hang’s (2003) investigation of activity theory in Singapore’s schools suggested that additional research is required to determine whether computers assist learners to engage in higher order thinking, or not.

At the same time, in a report written for Becta, entitled ‘Enabling teachers to make successful use of ICT’, Scrimshaw (2004) cited similar issues that were experienced in Singapore and the USA. Moreover, he recommended that educators, who are using computers as a ’supplement’ and not to their fullest capacity, should be challenged. Gibson (2002) argues that institutions that are training new educators must figure out how to teach their student educators (or pre-service educators) so that they, in turn, will be able to integrate computers into their own classrooms.

According to Strydom, Thompson and Williams (2005), schools that have acquired computers, use them chiefly for administrative tasks and primarily as a representational tool. However, research has indicated that merely placing computers in schools is not sufficient for influencing educators’ teachers and students’ learning (InfoDev, 2005). Therefore, responses from educators are required in order to provide a clearer picture of computer usage in classrooms.

Learners are of the opinion that technology could transform the way they learn in the future and there is a need to open dialogue between them and their educators (Knowledge Lab, 2007). With this in mind, educators and policy-makers need to map the way ahead strategically regarding the type of computer technologies to be used over the next five years, and what forms of learning these could lead to.

In concluding this section on the theoretical framework, it must be noted that there is a dire need for research into the role played by secondary school educators in the Western Cape central metropole as to the use of computers in their classrooms.

Many of the secondary school computer studies deal with sophisticated educational programs and computer resources, but give inadequate attention to the reasons why educators are not using computers in their teaching.

The reason for this could be that most of the literature on computers and education is to be found in developed countries, where computer resources are not as limited as they are in most South African schools. Consequently, this research has the potential to add to the literature in a manner that could enhance the use of computers in secondary schools throughout the civilised world.

1.5 Weakness in the literature

The literature reviewed covers a huge area relevant to this study. Although the review of the literature offers a sound theoretical and empirical foundation for the generation of hypotheses, there are nevertheless a few conspicuous lacunae. The design of the research methodology is aimed at addressing these gaps and validating or contesting the findings of previous studies.

The most conspicuous void in the literature is the paucity of empirical research in South African schools regarding educators' use of computers in secondary schools. Although the results of international studies may possibly be extrapolated to predict educators' use of computers in South Africa, it is critical that high-quality locally based research be conducted on the use of computers in secondary schools.

Comparing such results would enable educationists in SA to develop new structures and effect educational transformation that would be locally relevant. Follow-up research would assist the Department of Education to monitor trends in educators' use of computers. This could prove to be important for the development of pre-service educators and training programs.

Secondly, the process of encouraging educators and schools to use computers for lesson delivery in the classrooms should be seen as comprising two separate issues namely: educator motivation and whole school drive to use computers.

By concentrating only on schools that are at the most sophisticated levels of computer development, the literature fails to explain how schools have migrated from level to level.

Thirdly, the literature is parsimonious regarding the role that computers are playing in schools confronted by huge problems, such as funding, incompetent leaders in schools, ageing staff, and computer-illiterate educators. It would be amiss to believe that training alone will solve some of these problems; they are too complex for facile solutions.

1.6 Research problem and research question

1.6.1 Research problem

Schools in the Western Cape are in an educational crisis and there are critical issues relating to the use of computers in education (Dugmore, 2004). Better computer utilisation in schools therefore holds real promise for facilitating greater inclusion in existing educational streams, thereby accelerating educational innovation (Ofsted, 2001; Bank, 1998; Howie *et al.,* 2005).

Moreover, the above studies depict the problems that are prominent in the classrooms of developed countries. Consequently, one might also expect these problems to be more severe in South African schools (Strydom *et al*., 2005).

A few studies of a similar nature to the present study have been conducted and used to provide an impetus for this study. The Govender (2008) study investigated the integration of computer technology, namely the use of the Khanya mathematics program to improve learner performance. Govender's study was an evaluation of the Khanya project limited to grade twelve and mathematics only.

Addo's (2003) evaluative study investigated the utilisation of ICT in the World Bank's Links for Development (WorLD) global education networking program schools in South Africa. His study established that the educators did not use the teaching methods that supported the integration of computers in education.

The Chapman (2003) study investigated factors that influenced business teacher educators to adopt computer technology. Her study found that social, organisational and personal motivational factors were important in influencing educators to adopt computer technology for teaching purposes.

The Isaacs (2007) study provided insights into the activities and problems related to computer use in education. It provided useful information on the various ICT interventions undertaken by each of the nine provinces' education departments in South Africa. Her study provided momentum for the present study. She showed that there were many computer technology programs in progress, yet computer usage nevertheless remained low.

Some of the shortcomings in the above studies will be investigated in this study. This fact alone should render this study important.

The legacy of apartheid in education is persistent and there is strong evidence that South Africa is behind other developing countries in terms of the quality of its educational outputs (Strydom *et al.,* 2005; SACE, 2005). Therefore, research involving curricula innovations and successful implementations for progressive educational reform are critically necessary to improve the quality of teaching outputs.

Thus, the research problem centres on the need for secondary school educators in the Western Cape central metropole to harness the power of the computer to teach in their classrooms.

The literature review serves to elucidate the field of investigation, as demarcated by the research problem. Educational technologies and factors affecting the use of computers in education are the important foci of attention.

1.6.2 Research Questions

The primary research question that directs this study is:

What are the contributing factors in the use or non-use by secondary school educators of computers as instructional tools in their classrooms?

The intention is to provide the WCED and the principals of secondary schools in the central metropole with an implementation plan or proposed model that will assist them to increase the use of computers by educators in their schools. Having articulated the issues that educators encounter with computers in education, the following subsidiary questions can be formulated that will guide this study.

1. Do educators' theories and beliefs have any impact on computer usage?
2. Do secondary school educators have the necessary access to computers?
3. What is the impact of educators' attitudes on using computers for teaching purposes?
4. What support do the educators' receive to use computers for pedagogical enhancement?
5. Does training make any difference in the level of computer use by educators?
6. Do computers have any effect on the educators' pedagogies?

The clarification of the research problem and the research questions will be given more transparency in the discussion of the purpose of the study and the research objectives in the next section.

1.7 Purpose of the study and research objectives

1.7.1 Purpose of the study

The purpose of this study is to map the experiences, opinions, expertise, and ideas of principals and educators with regard to the use of computers in secondary schools in the Western Cape central metropole.

Based on Rogers' (2003) Diffusion of Innovation Theory, this study will investigate the associations of selected variables and how they relate to teaching and learning. This study aims to contribute to a better understanding of educators and their responsibility in using computers as instructional tools in their teaching. This study is primarily directed at secondary school educators and principals.

Moreover, this study could provide primary school principals with a realistic resource for the implementation of computers in their schools too. Accordingly, the study may be beneficial to the WCED and educationists in the following ways:

With an informed understanding of how educators use computer technology, this study will develop a framework or propose a model on computer usage for teaching purposes. This could increase the level of usage by educators in secondary schools. The development of an implementation plan or model may assist educators to be better equipped to deliver computer-assisted lessons.

The contribution and value of this study on computer usage could increase the self-motivation of educators using computers in their teaching, and thus improve the quality of teaching in schools and benefit learners and all other stakeholders as well.

Therefore, it is imperative to investigate educators' use of computers in the present environment since the demands on curriculum delivery continually increase.

Finally, this study should be able to assist the South African Department of Education in improving their decision-making regarding the implementation of ICT policies in secondary schools - and other technological innovations as well.

1.8 Research objectives

The research questions are differentiated into specific objectives that delineate the field for each question:

- To obtain information about the ICT policies in secondary schools and how the principals are using these policies to implement ICT in their schools;
- To obtain information on how frequently secondary school educators are using computers in their teaching;

- To discover reasons why educators are not using computers in their teaching;
- To obtain information on whether educators are receiving the required support provided by the school and the Department of Education;
- To obtain information on educators' training, theories and beliefs and their pedagogies;
- To get a deeper understanding of the factors that enhances the use of computers in secondary schools; and
- To develop a model that would enhance the use of computers by educators.

1.9 Methodology

1.9.1 Research Design

A research design is an outline of the procedures for conducting a study to get the most valid findings (Hussey, J and Hussey, R 1997). Furthermore, these authors believe the purpose is to design a study that will provide the answers required for decision-making. This study will employ a mixed methods approach, using both quantitative and qualitative methodology - because of the nature of the data needed. According to Evans (2004, p. 315), the benefits of a mixed methods approach are that, "the methods complement each other and the inadequacies of individual methods are minimised".

The quantitative aspect will measure which variables have the greatest impact on teaching when computers are used in the classrooms, while the qualitative approach will explore the perceptions and opinions of different school principals in depth.

1.9.2 Quantitative approach

The purpose of this study is to explain how certain variables affect computer utilisation for teaching in schools. According to Hussey, J and Hussey, R (1997, p.50), "these variables can be described in such a way that they can be measured."

Thus, a quantitative approach will be suitable for this aspect of the study. The quantitative research approach will make use of structured questionnaires.

These questionnaires will be developed from the literature using proven questionnaire design principles. These questionnaires will then be compared with the work of leading local and international academics in this field.

1.9.3 Qualitative approach

An important characteristic of qualitative research is its ability to achieve an understanding of social and human activities by exploring the situation in-depth (Hussey, J and Hussey, R 1997). This study will investigate in-depth factors difficult to capture through a quantitative approach. The qualitative research approach used for this in-depth study will be in the form of structured personal interviews.

1.9.4 Secondary data

An extensive literature search on computers in education and various factors pertaining to educator theories and beliefs will be undertaken. This will be accomplished by consulting a wide range of scientific journals, electronic databases and research publications. The literature review on computers in education and factors relating to educational theories and beliefs will be discussed in Chapter 2 and Chapter 3.

1.9.5 Data Collection

The data used in this study will be collected by using the methods listed below. A comprehensive discussion on each of these methods will be given in Chapter 5:

(a) Closed and open-ended questionnaires;
(b) In-depth interviews;
(c) Classroom observations; and
(d) Curricula-policy documentation.

1.9.6 Population

The population of this research comprises a body of people that the researcher wishes to investigate (Hussey, J and Hussey, R 1997). These are educators teaching in secondary schools in the Western Cape central metropole.

There are 1816 (n=1816) secondary school educators and 60 (n=60) principals in the Western Cape central metropole (WCED, 2009).

1.9.7 Sampling technique and sample

According to Saunders, Lewis and Thornhill (2003, p.150), the purpose of sampling is to "provide a range of methods that enable you to reduce the amount of data you need to collect… rather than all possible cases." Two sampling categories would generally be used (Saunders *et al*., 2003).

(a) Probability samples: where each case or element in the sample stands an equal chance of being selected. The essential element of probability sampling is that it must represent the population (Saunders *et al.,* 2003).

(b) Non-probability samples, where the researcher is unable to determine the chance of an element being selected from the sample (Saunders *et al*., 2003).

In this study, the total population (probability sample) was used as the sample, because it was within adequate distance for the researcher to personally hand-deliver and collect all the questionnaires and responses from the interviewees. In addition, five schools were randomly selected for classroom observations.

1.9.8 Pilot study

A pilot study of the quantitative and qualitative questionnaire will also be undertaken in order to tease out any ambiguities or misunderstandings. Refinement of the questionnaires will be further discussed in Chapter 5.

1.10 Data analysis

1.10.1 Analysis of the quantitative data

Correlational analysis, multiple regression analysis and Analysis of Variance (ANOVA) will be used to find any associations between the variables. The statistical package SPSS, version 17.0 for Windows, will be used to capture and analyse all the quantitative data.

1.10.2 Analysis of the qualitative data

Interpretation of the personal interviews will follow the procedures as elucidated by Leedy and Ormrod (2001).

To interpret the data for themes and patterns, an interpretational analysis will be undertaken. Content analysis will be used to search for patterns in the data. Finally, reflective analysis will be resorted to - using the researcher's judgement to explain the situation.

1.10.3 Validity of the data

According to Hussey, J and Hussey, R (1997, p. 57), "validity is the extent to which the research findings accurately represent what is really happening in the situation". The research tool must ensure face validity by actually measuring what it is intended to measure: in this case the use of computers for teaching by educators.

The interviews and research tools must ensure content validity by measuring the use of computers by educators - and not merely the use of ICT in education. This study uses the literature to ensure that valid constructs are used in the computer usage model.

The validity of the data will be further discussed in Chapter 5.

1.10.4 The reliability of the data

Reliability is about the findings of research and whether such research can be repeated to produce the same results (Hussey, J and Hussey, R 1997). This may be achieved by developing research tools based on proven instruments that have been designed by international practitioners. Cronbach's alpha will be used to measure the reliability of the research tool used in the quantitative research. Cronbach's alpha is a measure of how accurately the sum score of selected constructs captures the expected score of the whole research tool.

A reliability coefficient of 0.70 or higher will be considered acceptable (de Vaus, 2007). Further elaboration will be given in Chapter 5.

1.11 The significance of and justification for the study

Czerniewicz and Brown (2005) believe that the use of computers by educators and learners will increase over a period. Computers will provide learners with the necessary skills required in an information society.

Since the Western Cape Education Department expects educators to use computers in their teaching, the results from this study could lead to some of the following benefits:

- The feedback from schools in the Western Cape metropole with regard to ways to increase computer usage for teaching: the study may provide detailed instructions to the Western Cape Education Department for the optimisation of their educator-training program;
- Schools in the Western Cape metropole, and perhaps in the rest of South Africa too, may be in a better position to manage their resources in order to increase computer usage;
- This study will provide a more updated picture of computers in education in the Western Cape metropole, and may assist policy-makers in the Western Cape and the South African Department of Education (SADoE) to implement computer technology policies in schools;
- Furthermore, it could offer policy-makers and educationists essential insights into the effective use of computers by educators; and in particular, the ways in which educators plan to use computers in the future; and
- Analyse the levels of educator computer usage and the factors related to it. This might provide insight into the development of new policies and it could assist neighbouring African countries starting to integrate computers into their educational programs.

Equipped with the findings of this study, policy-makers and educationists should be guided to make better-informed decisions that could result in more schools becoming centres of excellence.

The study will attempt to highlight how computers can be used by educators for teaching purposes, as well as the factors that are inhibiting - instead of advancing - their use. In addition, this study will add information to the body of knowledge relating to the use of the computers in education and to develop a model for increased use of computers in secondary schools.

In particular, this relates to the degree to which educators are using computer technology for teaching purposes. It is expected that this study will provide solutions to the questions being posed about the impact of computer technology on education.

In view of all the multifarious permutations regarding computer integration and utilisation in education, this study is extremely important when seeking to understand the complexities of successful implementation in secondary schools in the Western Cape central metropole. The study should produce empirical evidence on how educators are using computers during their lessons, as well as factors that are hindering or accelerating this process.

This evidence hopes to lay the foundation for an increased level of computer usage in secondary schools, and may enhance the way educators teach and learners learn.

1.12 Scope and limitations of this study

This study will be undertaken to provide a clear picture in an environment where issues, such as computer technology, the digital divide and the knowledge economy, are not yet clearly understood. A few of the limitations must, however, be pointed out. This research will be limited to secondary schools under the jurisdiction of the Western Cape Education Department. It will exclude primary schools, further education training colleges and higher education institutes, such as universities.

Furthermore, the study will be limited to the self-reported perceptions of educators teaching in the geographic area of the Western Cape (WC) central metropole. Another limitation of the study is that it will not logistically be possible to include all secondary schools in the WC central metropole to observe firsthand how lessons are actually being conducted. The study will instead use random sampling to select five schools for observation.

This study will also not include the participation of learners.

Therefore, due to the specific delineation of the scope as stated above, extreme care should be taken to generalise the results of this study to other provinces of South Africa or even to the Western Province in its entirety. However, it is believed that results of this study and the eventual proposed model for enhancing the use of computers by educators in secondary schools may be of value to all people involved in education.

1.13 Exposition of chapters

This investigation will include the following chapters:

1.13.1 Chapter One: Introduction and background

This chapter provides an overview of the entire research. It includes sections such as the context, the background to the problem, the relevance of the study, the problem statement, research questions and a delineation of the research. This is followed by a brief outline of the remainder of the thesis.

1.13.2 Chapter Two: Theories of educational change

It is necessary to understand how knowledge can assist educationists in planning change. In this chapter, the main theories and concepts found in the literature will be highlighted. It is important to undertake an intensive study of a few theoretical models, since theoretical concepts from theories and models provide a solid foundation for the theoretical framework. This chapter will present the important theories and models used in this research project.

1.13.3 Chapter Three: Conceptual framework and literature review

This chapter will be a review of the latest and most relevant literature that will provide the theoretical framework for the study. In addition, the researcher engages with the relevant literature regarding the use of computers in an educational environment.

1.13.4 Chapter Four: Implications of effective teaching: technology integration

The following models and theories will be explored: Diffusion of Innovation theories, technology-acceptance models, factors related to computer use, theory of planned behaviour, theory of perceived ease of use, theory of educational change, educator change, as well as models of curriculum innovation and pedagogy.

Rogers' model of DOI will be used in the study to determine the variables and factors that would influence secondary school educators in using computers for lesson delivery.

1.13.5 Chapter Five: Research design and methodology

In this chapter, the research methods used to arrive at answers to the research questions will be discussed. Aspects to be covered here will include the instruments used to conduct the study, the procedure followed, the research design and the data analysis. A detailed description of the various methods used will be provided in subsequent sections. Furthermore, the chapter will provide a theoretical justification for the research design and methodology.

1.13.6 Chapter Six: Presentation of results

Chapter 6 will present the findings of the study. These will indicate the statistical data that highlight the relationships among the various independent variables and the dependent variable. In addition, Chapter 6 will also provide statistical results applicable to the research questions in the study.

1.13.7 Chapter Seven: Principals' role in the use of computers

In this chapter, the main findings relevant to the roles of principals regarding the use of computers in their schools will be integrated and presented as a practical strategy. Moreover, the chapter will present the findings of the qualitative data collected from the thirty-two questionnaires completed by the principals in their respective schools.

The objective of the principal questionnaire was to establish the role that the principals play in the use of computers in their schools.

1.13.8 Chapter Eight: Conclusion, summary and recommendations

The final chapter will summarise the important findings and discuss the extent to which the objectives have been realised. This chapter will also discuss the deficiencies of the research and offer some recommendations for further research. The study will be brought to a close with these recommendations for future research. In addition, a proposed model emanating from the findings of this study is discussed.

The conclusions will be supported by the literature review and findings from the questionnaire surveys presented in the preceding chapters.

1.14 Conclusion

This chapter has provided a brief discussion of the background to the research problem, the problem identification, the main objectives, the research questions and the assumptions, which have guided this study. The inclusion of computers in education in the Western Cape Education Department has been a complex process.

Reformers are of the view that educators play an integral role in technology acceptance, and it is only through their participation that changes can be satisfactorily implemented.

Many studies (e.g. that of Isaacs, 2007; Lundall and Howell, 2000 and Govender, 1999) have been conducted on adoption levels of ICT in South African schools. These studies, however, have not been able to provide any evidence on the adoption levels of computer use for teaching purposes. This study addresses this gap in the literature and the factors relating to it.

Forty-one years ago, Ausubel and Robinson (1969) hoped that new educators would be able to adjust to the new roles of using computers in their instruction from the start of their teaching careers. Educators have made little progress towards the advanced use of computers and their integration into education (Cox, 2000). This has created a false impression on the level of computer use and the actual level of technology use by educators (Strydom, *et al*., 2005).

This could lead to important educational reforms in the policies regarding computer technology implementation in schools.

The above-mentioned chapters describe the scope of the study and give an indication of what can be expected from this thesis. The next chapter will present an in-depth discussion of the important theories and models that will serve as a foundation for this study.

CHAPTER 2

THEORIES ON THE USE OF COMPUTERS IN TEACHING AND LEARNING

2.1 Introduction

This chapter presents an overview of the main theories and theoretical models that have influenced computer use in education. Researchers are keen to understand the various theories and models that may predict the behaviours of individuals across many disciplines. Therefore, it is important to understand the models in the technological, behavioural and educational disciplines - including the factors that influence them.

It is important to understand these models, since the use of computers in teaching is a major change that educators must consider. The literature on the implementation and use of computers in education has shown that individuals in the education profession change their habits slowly and defend them tenaciously (Pelgrum and Anderson, 2001).

In order to acquire an informed view as to why educators are not using computers in their teaching, it is necessary to undertake an intensive study of some of the most prominent educational, behavioural and technological models. Some of the concepts from these models will provide a solid foundation for the theoretical framework in this study.

This chapter will explain the various technological and educational models and theories from which certain aspects have been taken and used in the present study. These models and theories will enable the development of a comprehensive understanding of educator adoption of computer technology to formalise the theoretical framework for this research.

2.2 Theoretical models that underpin this study

Theoretical models are used in research for various reasons. Because variables form the basis for statistical analysis and assist in illustrating hypothesised associations and explanations (Britt, 1997), these theoretical models can assist researchers in clarifying the important variables under study. Considering that the implementation of computers in schools is a major undertaking, it is necessary to understand how information on this process will be able to assist educationists in planning for change.

Hurst (1983) is of the view that any change in an educational system can be narrowed down to control and change models. The reason for studying these models is to investigate how to promote the use of computers and how to overcome the barriers impeding the adoption of computer technology in schools.

This chapter will thus review and discuss the following six technology models and four educational theories as a guide for this research.

The technology models are:

(1) The Theory of Reasoned Action (TRA)
(2) The Theory of Planned Behaviour(TPB)
(3) The Technology Acceptance Model (TAM)
(4) The Technology Acceptance Model 2 (TAM 2)
(5) The Unified Theory of Acceptance and Use of Technology (UTAUT)
(6) Diffusion of Innovations (DOI)

The educational theories are:

(1) The Problem Solving Model
(2) The Social Interaction Model
(3) The Research, Development and Diffusion Model
(4) The Linkage Model

2.3 Technology models

2.3.1 The Theory of Reasoned Action

Ajzen and Fishbein (1980) developed the Theory of Reasoned Action (TRA). This is a generalised theory on the relation of beliefs to behaviours. There are three general constructs that make up the TRA: (1) behavioural intention, (2) attitude and (3) subjective norms. The TRA (see Figure 2.1) postulates that an individual's beliefs influence his/her attitudes, which then form a behavioural intention.

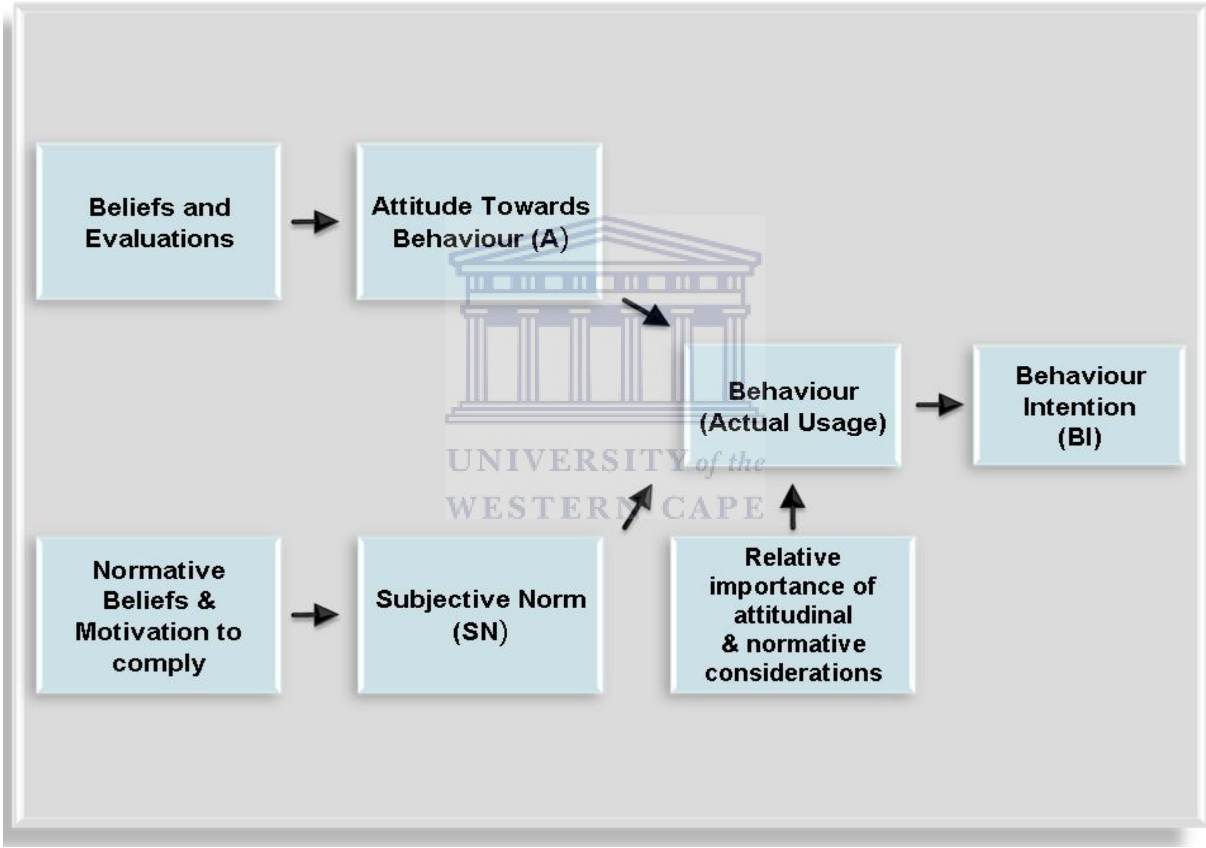

Figure 2.1: Theory of Reasoned Action (Ajzen and Fishbein, 1980)

Behavioural intention is an individual's cognitive strength of the intention to perform a specific behaviour. In the TRA model (see Figure 2.1), the two main constructs are attitudes and subjective norms. These have an impact on intention. Attitudes consist of beliefs about the evaluation of performing certain behaviour.

A subjective norm is the social pressure or perceived expectations from relevant people to perform this behaviour (Fishbein and Ajzen, 1975).

In other words, users consider other people's views before they make a decision. An example is:

Attitude: I think eating non-vegetarian food is bad for my health.

Subjective norm: I bet my wife wants me to stop eating non-vegetarian food.

Intention: I want to stop eating non-vegetarian food.

Behaviour: I am going to a dietician, and I have not eaten non-vegetarian food in 3 months.

Much of the literature relating to technology acceptance has its roots in the TRA model, although the Theory of Reasoned Action has been revised and modified by Ajzen. In the process, it has become the Theory of Planned Behaviour. According to Fishbein and Ajzen (1975), the Theory of Planned Behaviour has been applied in many studies. It is an all-purpose, well-researched intention model. The extension to the theory of planned behaviour includes a major predictor, namely perceived behavioural control.

2.3.2 The Theory of Planned Behaviour

The Theory of Planned Behaviour (TPB) is a prescriptive model that can be used to conceptualise the educator's use of computers. The theory of planned behaviour (Ajzen, 1988) is an extension of the theory of reasoned action (Fishbein and Ajzen, 1975). It accounts for conditions where people do not have complete control over their behaviour (perceived behavioural control). According to Fishbein and Ajzen's (1975) theory of reasoned action, behavioural intention plays a major role in a person's actual behaviour.

The TPB lists the following elements of the decision-making process: attitude, subjective norm and perceived behavioural control.

The TPB model (see Figure 2.2) allows for situations where educators do not have complete control over their behaviour.

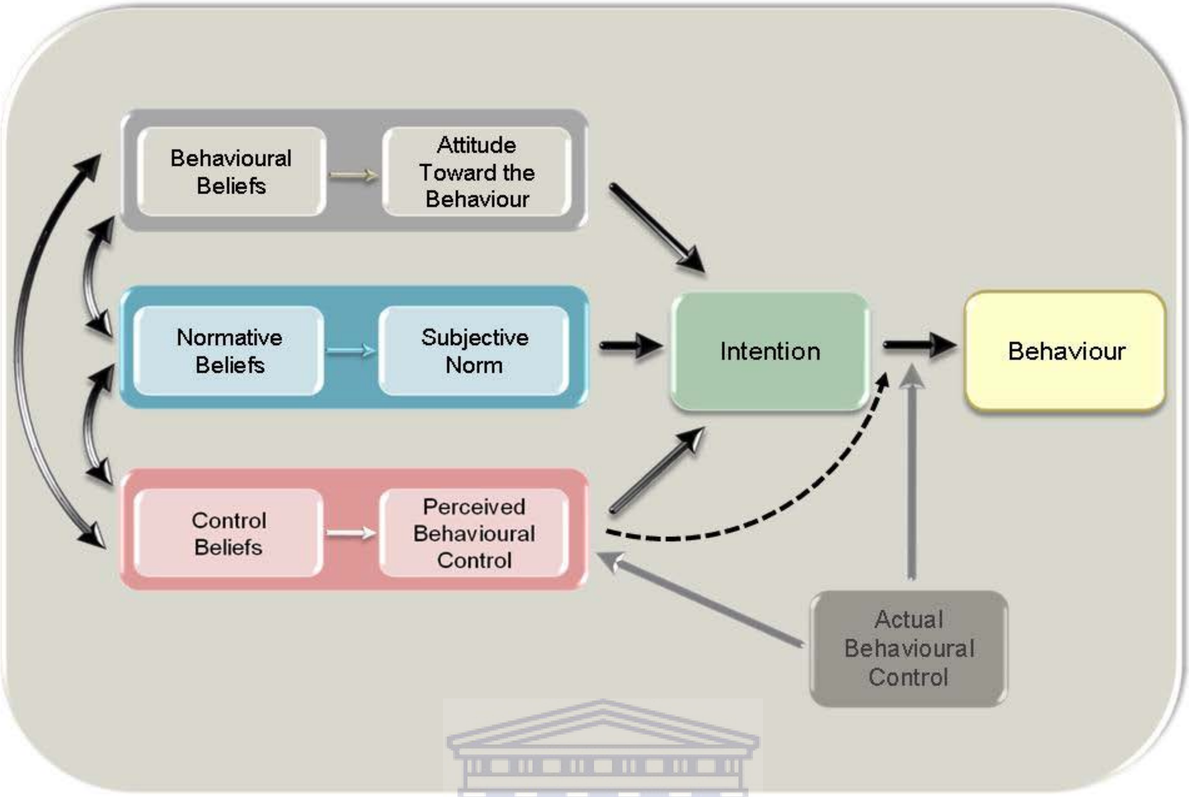

Figure 2.2: Theory of Planned Behaviour (Ajzen, 1991)

TPB predicts intentional behaviour because a person's behaviour can indeed be planned. According to Ajzen (1988), three categories of thought guide human actions. Firstly, the theory of planned behaviour suggests that behavioural intent is influenced by the attitude towards that behaviour. Attitude is influenced by the individual's 'behavioural beliefs'; that is what the individual believes about the behaviour.

Secondly, the subjective norm, which is the influence of social pressure as perceived by the individual, decides what impact the influence of social pressure will have on the individual and the motivation to comply with the normative beliefs.

According to Fishbein and Ajzen (1975, p.302), it is "the person's perception that most people who are important to him or her think he should or should not perform the behaviour in question".

Thirdly, TPB predicts the individual's perception of how easy or difficult it is to perform that behaviour (perceived behavioural control). For example, if two people have the strong intention to learn a new language, then the one who thinks he will succeed in perfecting his use of this language is the one who will persevere longer than the other (Ajzen, 1991).

There are two important aspects to this theory: Firstly, behavioural control has motivational intent; and, secondly, there is the possibility of a direct link between perceived behavioural control and behaviour (Ajzen, 1988).

For example, educators may have strong intentions to use computers for teaching, but, due to a lack of resources, they will probably not form strong behavioural intentions to implement these intentions. Therefore, the greater the attitude and the subjective norm are, and the more favourable the perceived control, the stronger the individual's intention will be to perform the particular behaviour.

According to Fishbein and Ajzen (1975), there is evidence that users' attitudes are positively related to computer usage, since users' attitudes play an important role in influencing their behaviour. A limitation of this model is that it assumes that the majority of people first consider the repercussions of their actions before they decide to adopt certain behaviours.

This is not always true. In addition, it assumes that people are level-headed, and will use any information they possess efficiently. The model further ignores emotional variables, such as mood, fear, anxiety or any threats.

An advantage of this model, however, is that it takes into consideration the individual's perception of controlling his/her behaviour.

2.3.3 Technology Acceptance Model

Fred Davis (1989) designed the Technology Acceptance Model (TAM). Developed under contract with IBM Canada in the mid 1980s, the TAM was used to evaluate the market potential for PC-based applications to guide investments in new product development. The Technology Acceptance Model is a theory (see Figure 2.3), which explains how users come to accept and use a certain technology.

The model proposes that there are a number of factors, which have an influence on users when they are faced with a new technology. This model uses the seminal work of Fishbein and Ajzen's (1975) theory of reasoned action (TRA) as a base.

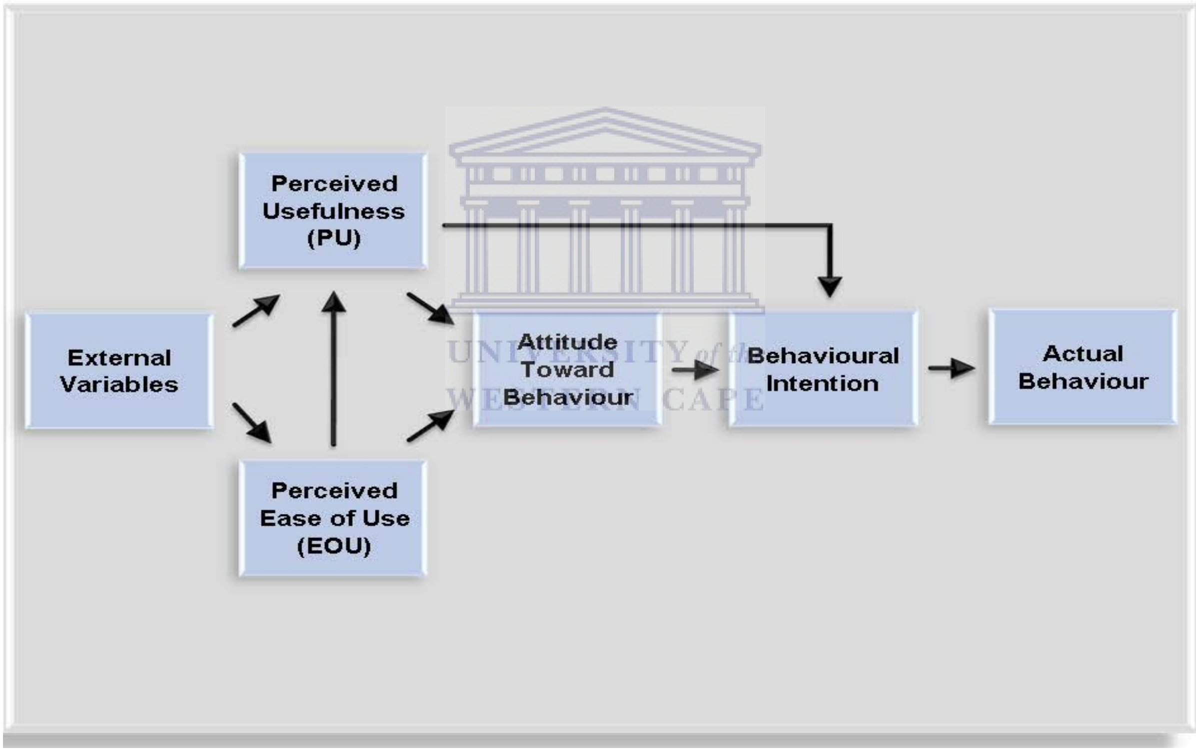

Figure 2.3: Technology Acceptance Model (Davis, Bagozzi and Warsaw, 1989)

Chau (2001) regards this as one of the most prominent research models when investigating the use of new technology. The difference between the TRA model and the TAM is that the latter uses perceived ease of use and perceived usefulness as determinants of attitude.

Perceived usefulness is the degree to which an individual believes that the use of a particular system will improve his/her performance within an organisational context (Davis, 1989). Perceived ease of use is the degree to which an individual believes that the use of a particular system will be effortless (Davis, 1989). Thus, educational computer technology with a high level of perceived usefulness and perceived ease of use is likely to result in positive perceptions.

Davis, Bagozzi and Warshaw (1989, p. 985) described the contribution of the TAM quite aptly:

> [….] "The goal of TAM is to provide an explanation of the determinants of computer acceptance that is general, capable of explaining behaviour across a broad range of end-user computing technologies and user populations".

Davis (1989) argued that the attitude of users plays a significant role in their intent to use computers. He states that such attitudes are influenced by the ease of use and how relevant they will be in the user's occupation. In similar vein, he adds that attitude determines the user's intention; and therefore the actual use of the technology will ultimately rest on this. Likewise, if an educator ordinarily rejects computer technology, the probability that he will use the technology will be high if he perceives that the technology will be able to improve his performance or ease his pressure in the classroom.

In addition, scholars have identified that the lack of user acceptance of computer systems has long been an impediment to the success of technology usage (Jones, 2004; Jawahar, 2002; Jawahar and Elango, 2001).

According to Harris, Donaldson and Campbell (2001), the TAM offers a base that summarises the impact of beliefs, intentions and attitudes.

Moreover, this model specifies the underlying relationships between two key beliefs: perceived usefulness and perceived ease of use, on the one hand, and users' attitudes, intentions and actual computer usage behaviour, on the other hand.

In the literature there is evidence suggesting that the TAM has emerged to become one of the most influential, powerful and concise models for predicting user adoption and usage behaviour.

Davis (1989) validated the original instrument for measuring these beliefs and a few authors (Adams, Nelson and Todd, 1992; Mathieson, 1991; Segars and Grover, 1993) replicated his original study, providing empirical evidence on the relationships between usefulness, ease of use and actual system use.

Other researchers also used the instrument extensively to demonstrate the validity and reliability of Davis's instrument, while investigating issues in the area of user acceptance (Moore and Benbasat, 1991; Chin and Gopal, 1993; Venkatesh and Davis, 1994).

2.3.4 Technology Acceptance Model 2

Venkatesh and Davis (2000) extended the original Technology Acceptance Model. They did this in order to explain determinants of perceived usefulness and usage intentions in terms of social influences and cognitive instrumental processes. Furthermore, these scholars wanted to understand how the effects of these determinants change as the user's experience increases, over time, with the target system.

This model is known as TAM 2 (Figure 2.4) and was tested using longitudinal data in a voluntary and mandatory setting.

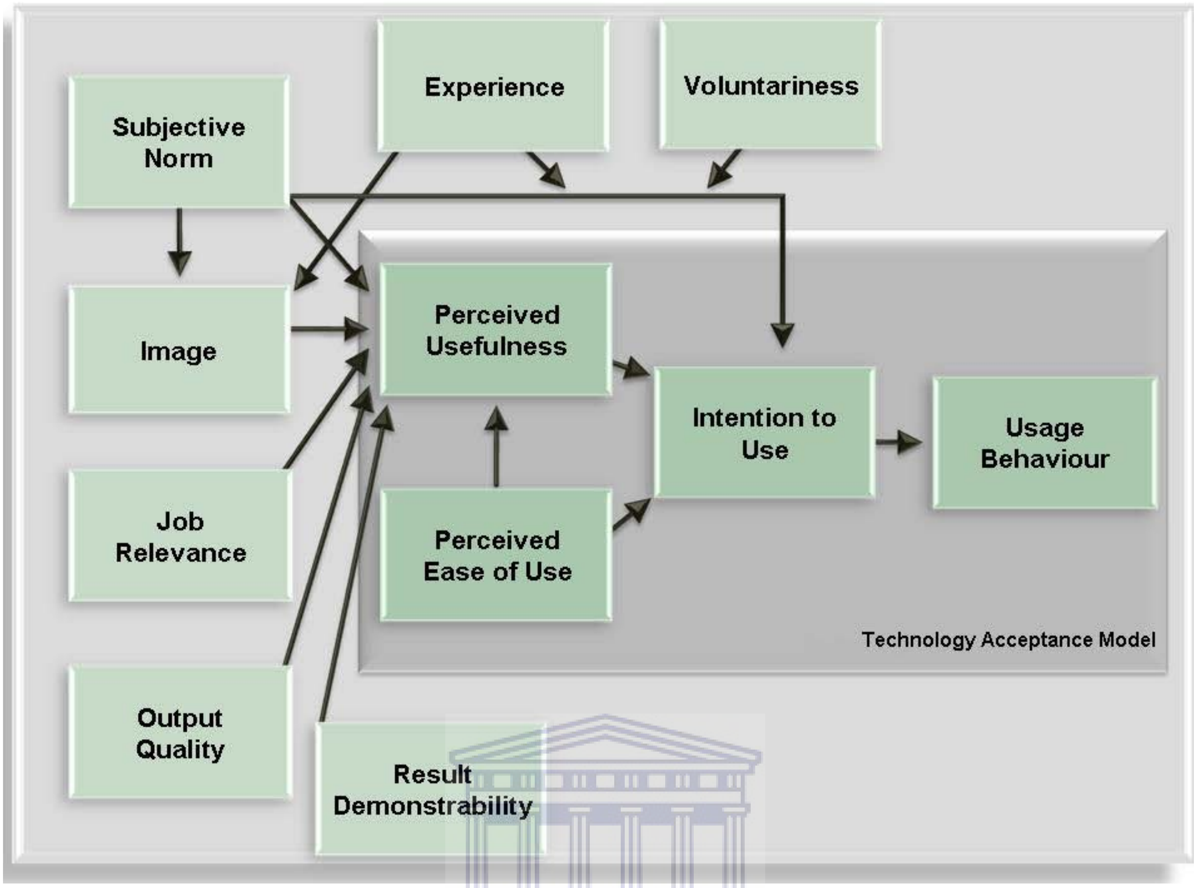

Figure 2.4: Technology Acceptance Model 2 (Venkatesh and Davis, 2000)

The four cognitive factors that influence perceived usefulness are: (1) job relevance; (2) output quality; (3) result demonstrability and (4) perceived ease of use. The three social forces that influence perceived usefulness are: (1) subjective norm; (2) image and (3) voluntariness. The reason for TAM 2 was the inclusion of two determinants to explain perceived usefulness and usage intentions and to understand the effects of these determinants over time.

The model was tested using data from four different organisations. The TAM 2 model was strongly supported by all four organisations in usage intentions. The cognitive factors are that if the benefits of using computers in education can be easily communicated to other educators, then there might be a greater chance that others may also use computers in their instruction. Social factors residing under 'Voluntariness' could be that if computers are mandated in schools, educators will then use the technology. However, this effect may lose its momentum over time.

2.3.5 Unified Theory of Acceptance and Use of Technology

In order to combine the most-used competing user acceptance models, Venkatesh, Morris, Davis, (G. B.) and Davis, (F. D.) (2003) formulated the Unified Theory of Acceptance and Use of Technology (UTAUT) model. Four factors were identified, namely (1) performance expectance; (2) social influence; (3) facilitating conditions and (4) effort expectancy. These factors were formulated for the UTAUT model to play an important role as direct determinants of usage intention and behaviour. Gender, age, voluntariness and experience are considered to mediate the impact of the four key constructs on intention and user behaviour (Figure 2.5).

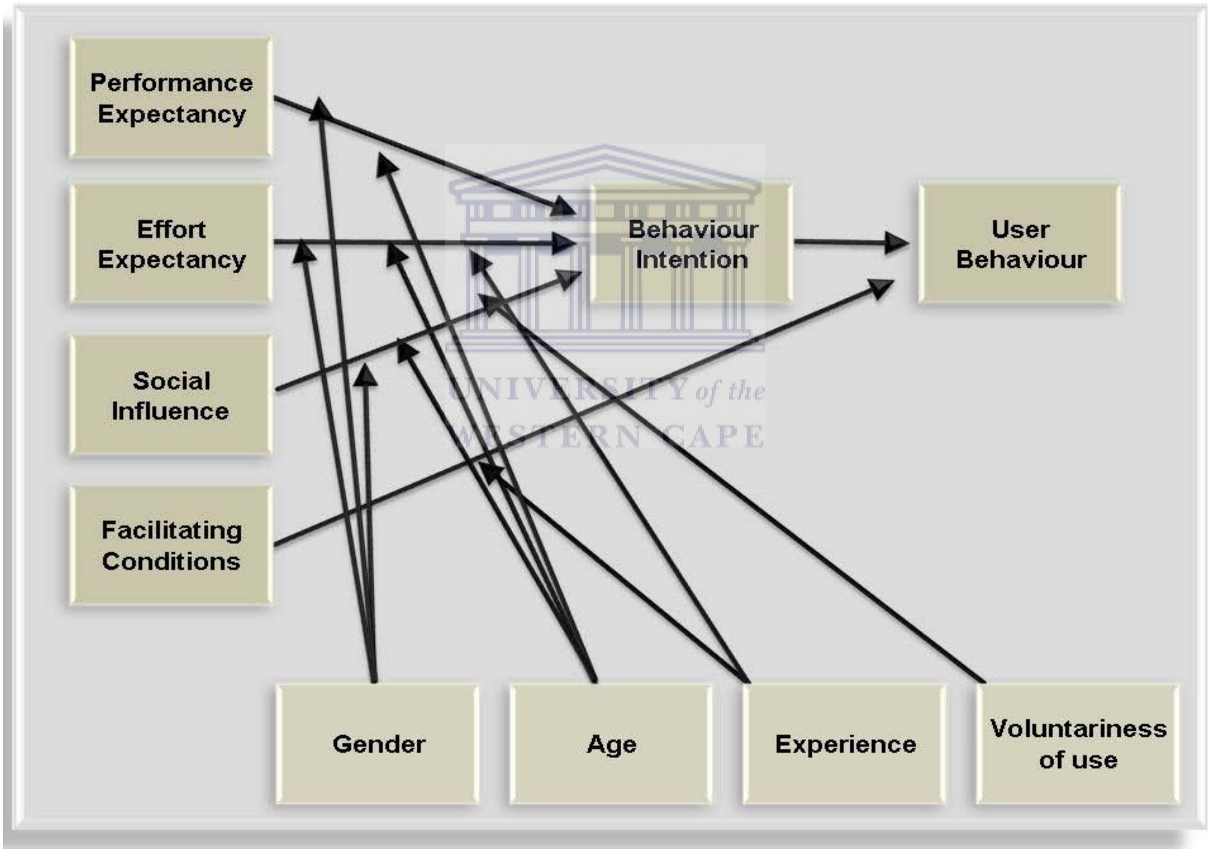

Figure 2.5: Unified Theory of Acceptance and Use of Technology (UTAUT) (Venkatesh *et al*., 2003)

According to Venkatesh and others (2003), the UTAUT provides a tool for managers or educationists to determine the possibility of success for new technology innovations.

Moreover, it will assist them in understanding the drivers of acceptance in order to design interventions aimed at users that may be less inclined to adopt and use new computer technologies.

2.3.6 Diffusion of Innovation Theory

Everett Rogers first designed the Diffusion of Innovation theory in 1962. An interesting note is that Rogers' father, who was a farmer, resisted the hybrid seed corn. A drought in 1936 caused the Rogers' farm to wither. This disaster inspired Rogers to become personally involved in using agricultural innovations in his diffusion research. In particular, he concentrated on the adoption and rejection of some innovations.

According to Rogers (2003, p.53), the study of the diffusion of innovations (DOI) can be traced back to the French sociologist Gabriel Tarde (1969), who attempted to "understand the process of social change".

Rogers' model (Figure 2.6) investigates the way in which innovations are diffused into a society. According to Rogers (2003, p.5), diffusion refers to "the process in which an innovation is communicated through certain channels over time among the members of a social system". Rogers defines innovation as "an idea, practice, or object that is perceived as new by an individual or other unit of adoption" (Rogers, 2003, p.12). He states, furthermore, that the DOI involves mass media and interpersonal communication channels, meaning that people can accumulate information about an innovation, and then perceive its usefulness.

Rogers' model consists of three elements: Firstly, those individuals who adopt an innovation over time, that is from innovators to laggards; and secondly, the decision-making process whereby an innovation is adopted or perhaps rejected; and finally, the criteria by which individuals rate the innovation.

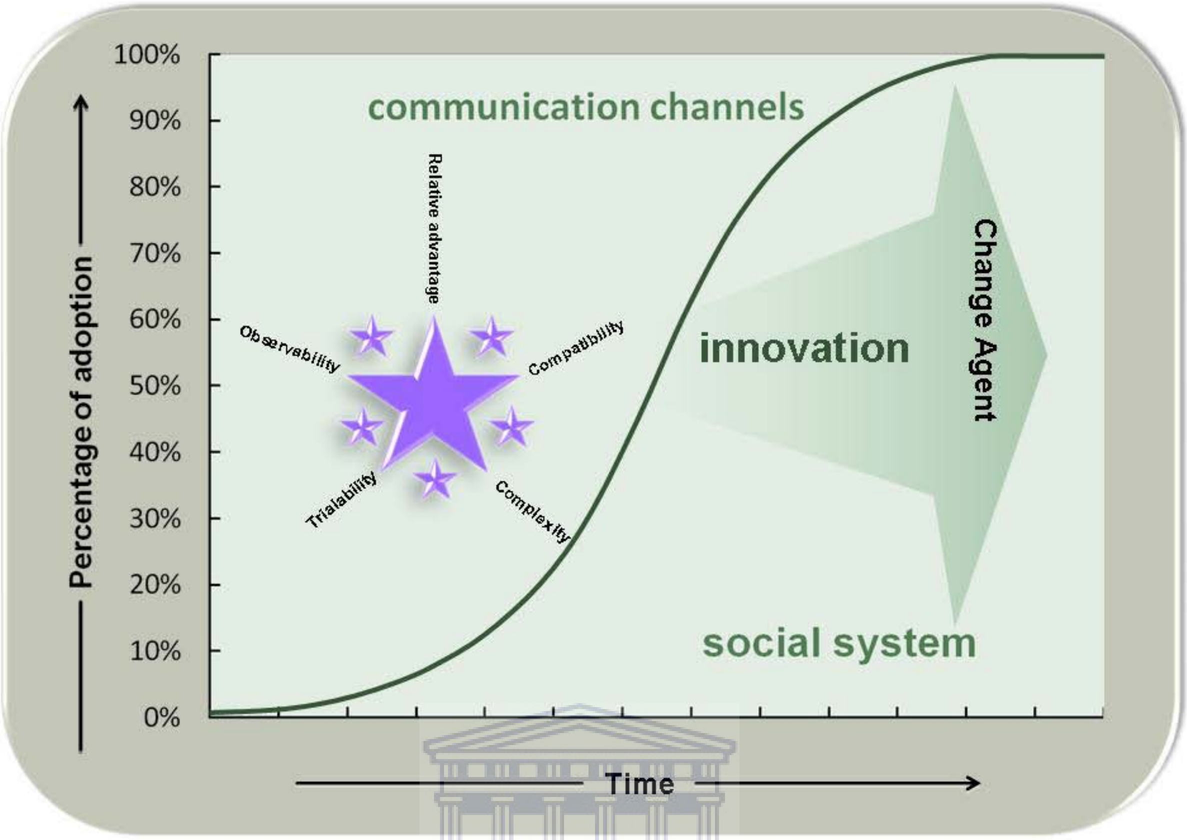

Figure 2.6: Diffusion of Innovations (Adapted from Rogers, 2003)

Rogers classified his groups according to their degree of innovation and the point in time when the innovation occurred. This enabled him to place adaptors in various categories and to draw diffusion curves. Rogers (2003) is of the view that, when the cumulative number of adopters is plotted, it will come out as an S-shaped (cumulative) curve. It accurately reflects the early adopters who originally chose the idea or innovation.

Closely related to the above discussion, it is important to note that the S-curve is "innovation-specific and system-specific," in describing the diffusion of an innovation among members in a particular system (Rogers, 2003, p.275).

2.3.7 Bell-Shaped frequency curve

Rogers asserts that the adoption process generally follows a bell-shaped (frequency) curve (Figure 2.7). Furthermore, he highlights five different types of adopters in the diffusion process, namely (1) innovators, (2) early adopters, (3) early majority, (4) late majority and (5) laggards.

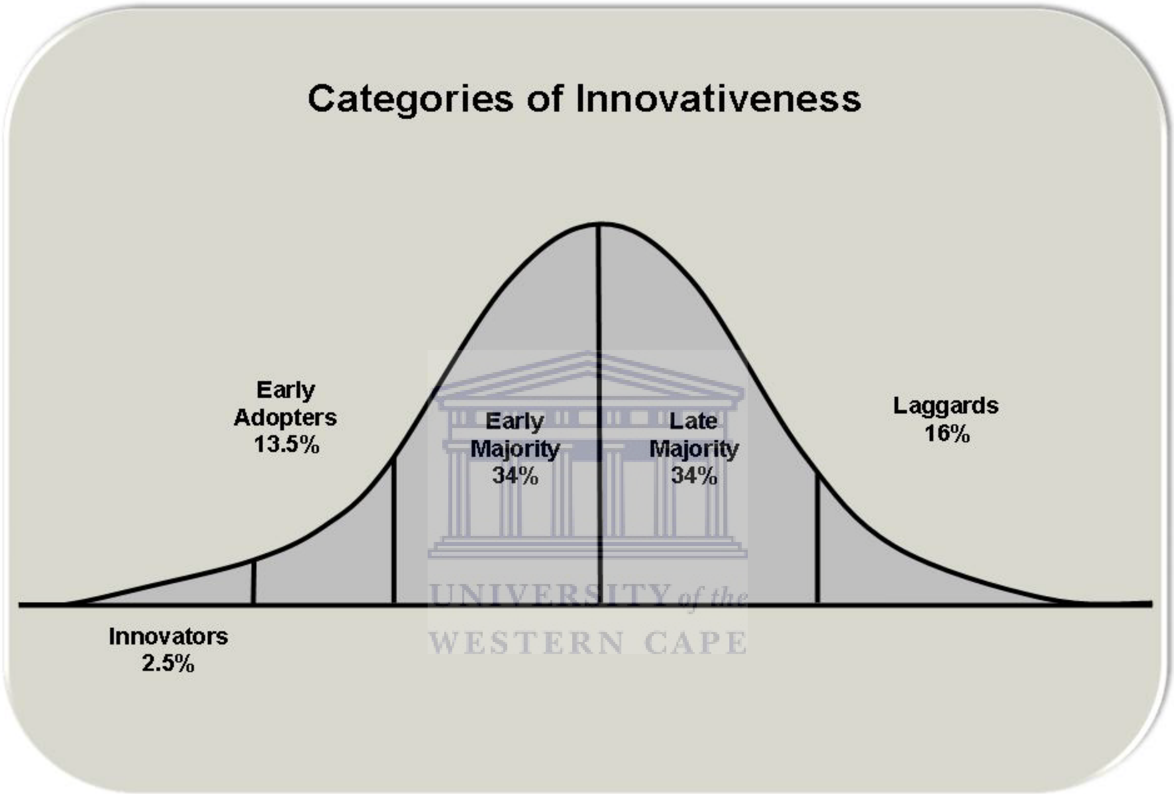

Figure 2.7: Adopter Categorisation based on Innovativeness (Rogers, 2003)

2.4 Categories of innovativeness

Rogers developed five adopter categories in order to make the possible comparisons. These are: innovators, early adopters, early majority, late majority and laggards. These will now be briefly discussed.

2.4.1 Innovators: venturesome

These types of innovators are often imaginative, committed and able to cope with a high degree of uncertainty about the innovation.

They are the audacious, futurist and wild-eyed revolutionaries, compared with others who feel threatened by change and risk-taking. These types of innovators (amounting to approximately 2.5% of any population) are those who have already adopted the new behaviour, and invested a lot of time and effort in it (Rogers, 2003).

2.4.2 Early adopters: respectable

These types of adaptors may be referred to as the respectable opinion leaders. These creative people (13.5%) embrace new ideas and are quick on the uptake as regards good innovations and their personal needs. According to Rogers (2003), this adopter category is often on the lookout for strategic leaps in their lives or businesses. Furthermore, he argues that "early adopters help trigger the critical mass when they adopt an innovation" (Rogers, 2003, p.283).

Early adopters are always open to risk and, in a sense, place their stamp of approval on any new idea once they have adopted it.

2.4.3 Early majority: deliberate

The early majority adopt with a decreasing degree of willingness and will not adopt without sound proof of the benefits. Other people, who have adopted the idea or innovation, would be an influence on them. The early majority is one of the biggest categories (34%), accounting for more than one-third of all members of a system (Rogers, 2003, p.284).

The individuals in this category normally contemplate all the possible issues for a while before its members decide to adopt an idea. They could be classified as followers in the adoption of innovations.

2.4.4 Late majority: sceptical

The late majority are the conservative pragmatists who have anxieties regarding any new ideas. They are disinclined to take risks, and normally only adopt new ideas much later than the average member of a system. Ironically, they do not really want to be left behind.

They constitute one-third (34%) of the members of a system. Innovations, for this category of people, are approached with ‘kid gloves’, as they are relatively scarce in resources and it is only the pressure from their peers that, by and large, motivates them to adopt innovations (Rogers, 2003).

2.4.5 Laggards: traditional

These categories of people are normally the last in a system to adopt an innovation. Laggards (16%) are from the old school and are generally the isolated few with scarce resources. In most cases, they tend to use the past as a point of reference in their decision-making. They possess very few opinions and leadership qualities. Rogers suggested that laggards tend to be doubtful about innovation and change agents (Rogers, 2003, p.284).

2.5 The innovation-decision process

Accordingly, Rogers (2003) mentioned that the innovation-decision process occurs over time in five stages (Figure 2.8). He states that the innovation-decision process is the process through which an individual passes from gaining first-hand knowledge of the innovation, to forming an attitude towards the innovation, to making a decision to adopt or reject the innovation, to the implementation of the new idea and to the final confirmation of this decision (Rogers, 2003, pp.168-169).

In the implementation of the computer technology literature, this model of innovation is one of the most well-known models associated with the adoption of technology. The five stages of the model are:

(1) Knowledge, where the individual becomes aware of the innovation and understands how it works.

(2) Persuasion occurs where the individual forms an opinion (positive or negative attitude) about the value of the innovation.

(3) Decision is the process whereby people decide to adopt or reject the innovation.

(4) Implementation occurs when the innovation is finally put to use.

(5) Confirmation takes place when individuals require feedback or information confirming the decisions they have already made.

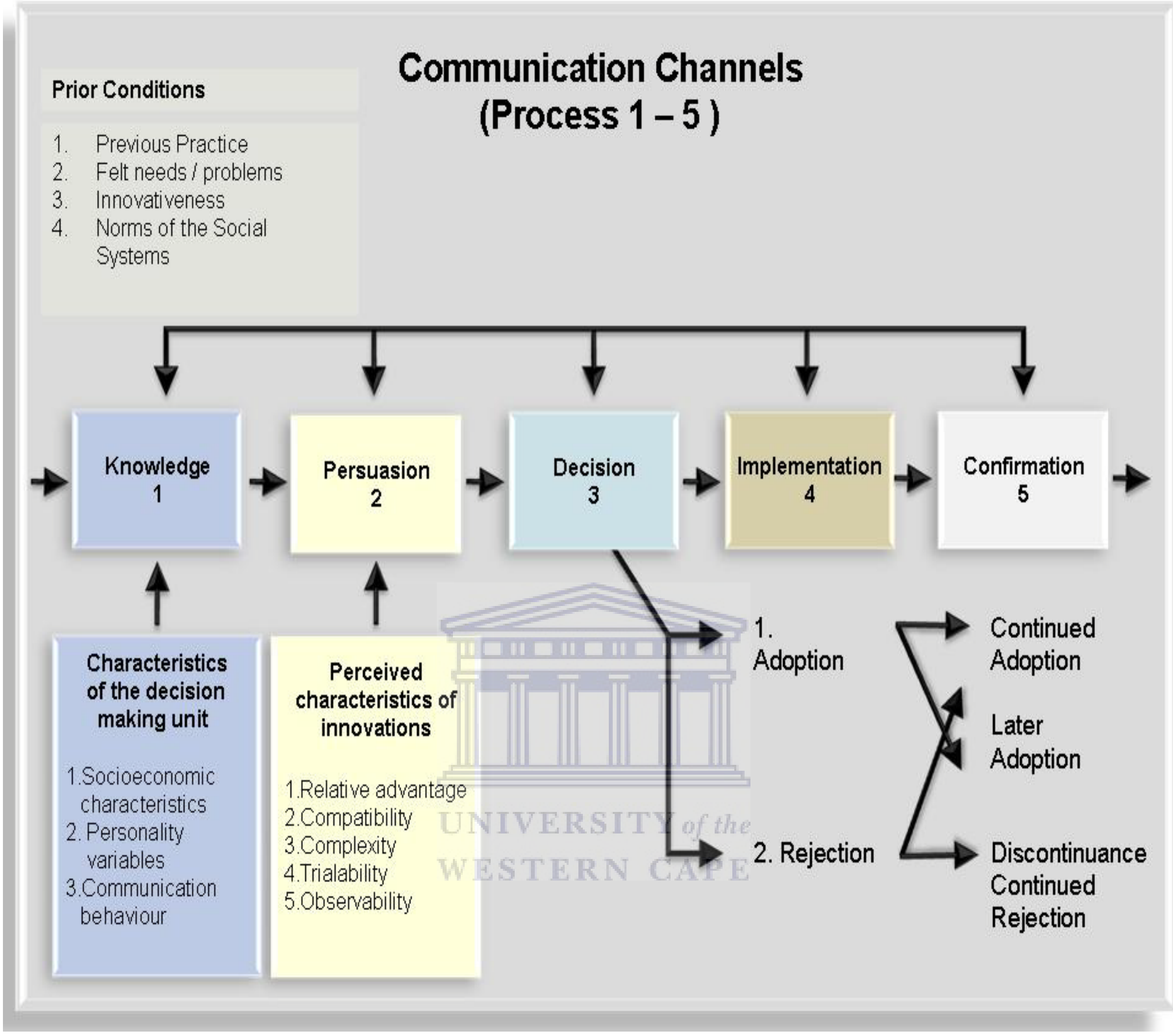

Figure 2.8: A model of the five stages in the Innovation-Decision Process (Rogers, 2003)

To specify and explicate the levels of this theory, Rogers (2003) advocated that an individual's perception about an innovation might be conditioned by a few factors. Some of them are previous experience and needs.

Social and economic status levels also have an influence on the way in which people process information about an innovation.

2.6 Characteristics of an innovation

There are five characteristics in the persuasion stage by which individuals perceive an innovation as being new or useful and decide whether to adopt it (Rogers, 2003).

They are: (1) Relative advantage; (2) Compatibility; (3) Complexity; (4) Trialability and (5) Observability which are now briefly discussed.

2.6.1 Relative advantage

This is the degree to which an innovation is subjectively perceived as being better than the idea that preceded it. Measured in economic terms, social factors such as convenience and satisfaction are equally important. Rogers (2003, p.15) argues that "the greater the perceived relative advantage of the innovation, the more rapid its rate of adoption will be".

2.6.2 Compatibility

Compatibility is the degree to which an innovation is seen as being congruent with the existing culture, values and needs of potential adopters. Rogers is of the view that an idea that is incompatible with the values and norms of a society will not be easily adopted, compared with one that is compatible. An example of an incompatible innovation is the use of contraceptives in countries "where religious beliefs discourage the use of family planning" (Rogers, 2003, p.15).

2.6.3 Complexity

Complexity refers to the manner in which an individual understands an innovation. Sometimes innovations are perceived as being difficult to use.

New ideas that are easy to understand and require less training are more rapidly adopted. Rogers (2003) gives an example of a health worker who tried to explain to villagers - who did not understand the germ issue - about the importance of boiling their drinking water.

2.6.4 Trialability

Trialability is the degree to which an individual can experiment or experience an innovation on a limited basis. New ideas that have the potential of being tried and tested will have a greater rate of adoption. Innovations that are trialable generally represent less risk for the individual considering them for adoption (Rogers, 2003).

2.6.5 Observability

According to Rogers (2003), the easier it is for individuals to see the results of an innovation, the more likely they are to adopt it. This visibility encourages discussions about any new idea among friends, as they often request innovation-evaluation information about it.

2.7 Summary of technology models

The literature suggests that most of the technology acceptance models discussed above have been used by many researchers as theoretical bases (Pownell and Bailey, 2002; Cox, 2000). Each of the models has its own set of advantages.

However, various predictors, such as performance, effort, and social pressures influence the intention and usage of behaviour variables. In other words, the stronger the predictor, the greater the strength of the model is likely to be.

The theory of reasoned action has some limitations. It comes from the surroundings of self-reporting used to determine an individual's attitude. Moreover, no direct observation is used in the application of this theory - only self-reported data. One may argue that self-reported data might be subjective, and therefore not always accurate.

Another shortfall of the TRA stems from the assumption that behaviour is under volitional control, meaning that this theory only applies to behaviour that is predetermined. Irrational decisions, usual routines or behaviour that is not predetermined cannot be accounted for by this theory (Conner and Armitage, 1998; Sutton, 1998).

The updated theory of reasoned action, now called the theory of planned behaviour, deals with the question of behaviours that occur without an individual's volitional control. The Theory of Planned Behaviour is the same as the Theory of Reasoned Action, except for the addition of the perceived behavioural control element. A few studies have proved this model suitable under certain circumstances, while some have proved it to be quite challenging to use (Conner and Armitage, 1998; Gagne and Godin, 2000; Sutton, 1998; Miller *et al*., 2006a).

Consequently, several extensions and modifications to the theory have been carried out. When applied in an educational environment, the TPB can modify the educator's teaching behaviour much as it does people's behaviour in other settings. To date, this theory has been used as a basis for many research studies (Chen, 2003; Omar, 2003) and is still considered the 'reference point' for most persuasion-related research (Ajzen, 2002).

The Technology Acceptance Model (TAM) is used to understand how people adopt new technologies. The model suggests that the attitude towards a new technology and the intention to use it are driven by the perceived usefulness and ease of use of the technology (Davis, 1989). In the uptake of computer technology literature, shortcomings of the TAM include its questionable heuristic value and limited expounding analytical power. This model, which has its emphasis in the design of system characteristics, does not include, or consider, the social influences of new computer technologies.

The diffusion of innovation model suggests that social change is essentially a process through which information about a new idea is diffused through society. This model is extremely important, as it explains the implementation of change, and how an innovation becomes adopted and integrated into daily use. Rogers (2003), believes that an innovation is an evolutionary process consisting of several stages.

The next section will discuss the different theories of educational change and educator beliefs.

2.8 Theories of educational change

2.8.1 Introduction

In order to improve the quality of teaching and learning, computers have been used as instructional tools in many developed and developing countries. Consequently, the use of computers in South Africa has been integrated into many subjects. This integration has been widely argued as being efficient in providing equal education to all learners (Becta, 2004).

Many organisations, especially universities, further education colleges and secondary schools are aware of these changing conditions and acknowledge that the computer is a strategic teaching tool for quality, efficiency and effectiveness (Hawkridge, 1990 cited in Webb, 2002; Fullan, 2001).

The use of computers in education is a major change that educators, nevertheless, need to implement. Therefore, it is necessary to understand which factors are responsible for the change processes. The process of educational innovation starts when critical masses of educators are adequately motivated to initiate such change (Scrimshaw, 2004; Fullan, 2001; Jones, 2004). Theory serves to provide a foundation for decision-making, and Kurt Lewin (cited in Fullan, 2001, p.8) was right in saying that, "there is nothing so practical as good theory".

There are instances where educators explain their decision-making as simple 'common sense'. These decisions are frequently based on unspoken theories. One can assume, then, that for such educators, theory is useful as long as it has relevance to practice in education and contributes to the resolution of problems in schools.

In the literature on educational theories and educator change, it has been found that there is no single all-embracing theory of educational change. Moreover, this is a sign of the complex nature of theory in education. According to Ribbins (1985, p.223), researchers "will not find a single, universally applicable theory but a multiplicity of theoretical approaches each jealously guarded by a particular epistemic community".

Griffiths (1997) is of the view that not all educational problems can be studied by using a single theory. He argues that there are some problems so complicated that no single theory is capable of addressing them. He believes that by using multiple theories, the problem might be better understood. It then becomes possible to look at it from different perspectives.

A discussion on some of the major models and theories on educational change reviewed in the literature thus follows. Each theory has something to offer in explaining behaviour and attitudes in the educational environment.

2.8.2 Overview of educational models

There are many models of educational change and reform, explaining how individuals respond to innovation and change. The innovation process is complex - and for this reason, a few models of curriculum change and innovations are discussed. However, these are only models, and do not represent any actual state of affairs. According to White (1988, p.120), “such models involve a simplification of actual events, and it may be difficult to match any particular instance with characteristics of any model”. Furthermore, he states, “these models do provide us with a scheme for helping to make sense of innovation” (White, 1988, p.121).

Accordingly, Havelock (1971) makes the point that where a single adopter is concerned, the progress from awareness to the implementation of an innovation can be seen as a learning curve (see Figure 2.9).

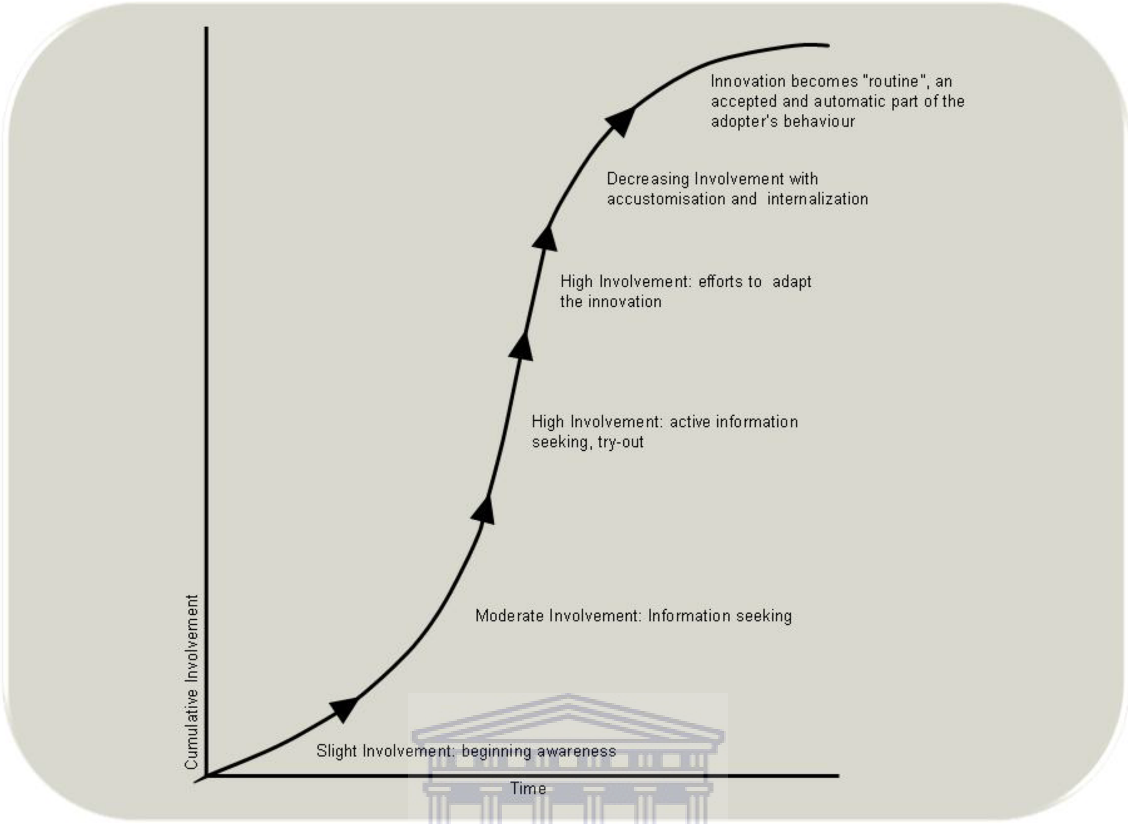

Figure 2.9: Involvement of an individual during the adoption process (Havelock, 1971)

Havelock (1971), believes that the process of educational change is concerned with an accumulation of adoptions by educators. In addition, he argues that groups of individuals (who could be educators or governing bodies) in turn influence other educators. Therefore, the diffusion curve looks like chain reactions, with the number of adopters increasing relative to the number of educators who have previously adopted the change process (Havelock, 1971).

According to Havelock (1971, cited in Huberman, 1973, p.36),

> “The context in which each potential adopter lives is different; his reference groups are different, his perceptions are different, and the norms of the group are interpreted differently by each. Their adopting behaviour . . . (and) adopting periods (will) be different, (and) . . . they will also become aware of an innovation at different times”.

Fullan (2001) is of the view that generating improvement by implementing the latest policy is not going to change much. He argues that there is more to reform, namely, changing the culture in classrooms, in schools and in educators' beliefs. Fullan (2001, p.11) states that "many attempts at change fail because no distinction is made between theories of change (what causes change) and theories of changing (how to influence those causes)".

Fullan further argues that the main problem in schools is not a lack of innovation, but the presence of too many fragmented and episodic projects that are forced onto educators, giving them a severe case of "projectitis" (Fullan, 2001, p.21).

Fullan asserts that educational change is technically simple and socially complex. It can be better understood by considering the 'change' paradigm in educational innovation. He posits the view that in order to deal with the future development of societies, the educator's capacity to handle change and assist students will be critical. Therefore, it is necessary to explain two contexts, in which innovations take place, namely the top-down and bottom-up approach, before discussing the change process.

2.8.3 Top-down and bottom-up innovations

The innovation process may happen in two different ways. Firstly, as a bottom-up process in which educators of the school initiate the innovation. This may happen when educators find the reason for a problem and decide to change it.

Within this context, "teachers may act with or without the help of an outside change agent" (Markee, 1997, p. 67).

Secondly, a top-down innovation occurs when it is introduced by an outsider, especially one involving major curricular reforms. The South African Outcomes Based Education (OBE) is one such example. This process of high-level discussions and agreements among top executives in the African National Congress (ANC) took place after the democratically elected ANC government came to power in 1994 (Musker, 1997).

Evidence has shown that those who actually design and implement the innovation and those who constitute the majority of its end-users are not usually involved in these consultations (Janson, 1997). Educators, institutions and students are not involved in the design of the new policy. They only take part in the adoption and implementation processes. The structure of the South African Department of Education is illustrated below (Figure 2.10).

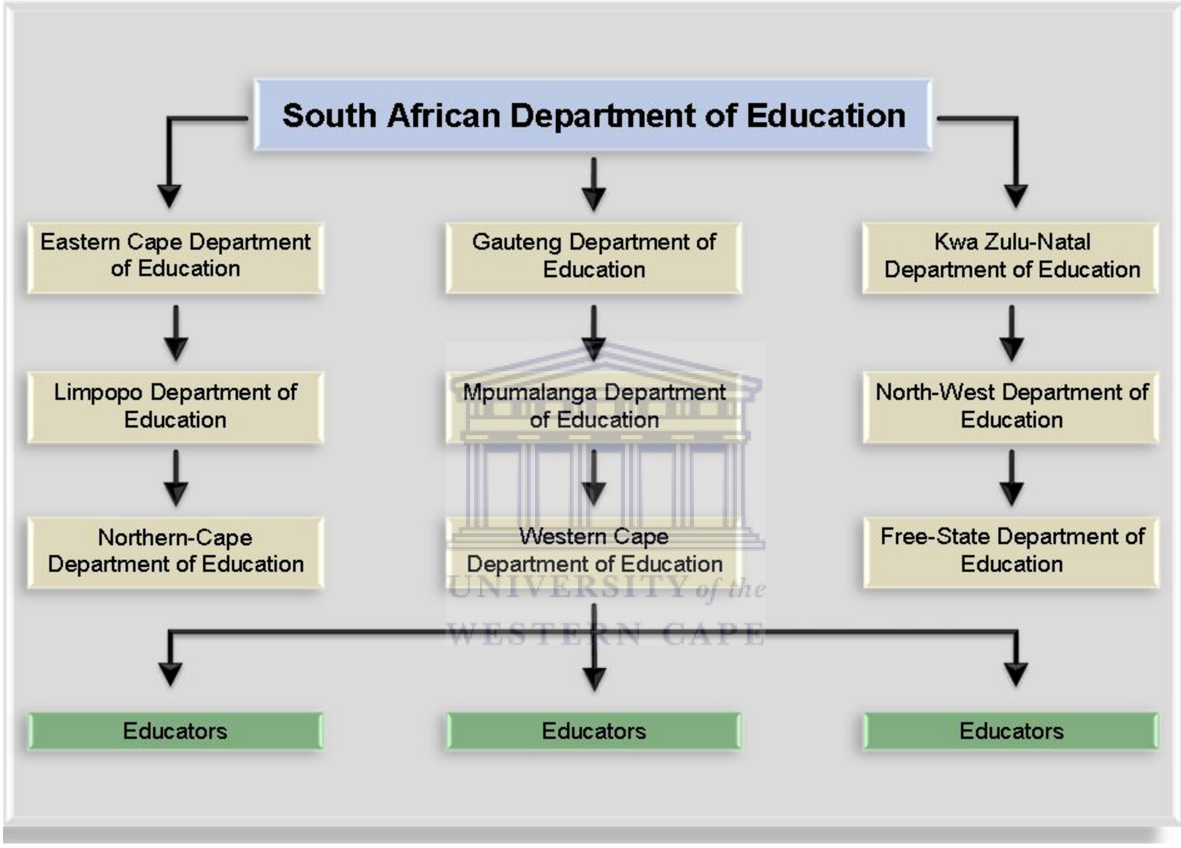

Figure 2.10: Structure of the South African education department

When (OBE) was introduced, it was a mistake to assume that ownership at these levels had already been established. In this context, it was evident that the educators did not see themselves as 'change agents'. Consequently, there was a mismatch between the educators' discourse and their practice. The emphasis of a bottom-up rather than a top-down model of implementation is more suited to the contemporary way of initiating educator-initiated innovation.

Next follows a discussion of some of the important models of educator change, together with their strengths and limitations.

2.9 The change process

Every social organisation, school or person is involved in some sort of problem-solving process and often someone makes the mistake of assuming that once change has started, educators will see that it is going to take place (Havelock, 1973). This is seldom true. Change causes fear and a sense of loss of the familiar - and it is frequently followed by resistance.

Therefore, it takes some time for educators to understand the meaning of the change and commit to it in a significant way (Fullan, 2001).

It is important to understand that most people go through various stages in their efforts to deal with change. Policy makers and educationists must understand that there are standard progressions, which will help school principals and district managers to avoid under-managing change or over-reacting to resistance (Fullan, 2001).

There are many stages and models in the change process, which are beyond the scope of this research. However, three stages will be briefly discussed.

2.9.1 Stage one: Denial

According to Havelock (1973, p.6), a strategy that educators use to cope with changes is to deny that such changes are happening, or to deny that they will continue or last. The most effective strategy that educators use is: “If we ignore them, they will go away.” He states that these are common responses in the educational community.

2.9.2 Stage two: Anger and resistance

When educators can no longer deny that something (a disturbance) is happening or has happened, they tend to move into a phase of anger or resistance.

The management of this phase is critical for the success of the change implementation. Leadership is required to help work through the anger and resistance and to motivate educators to move to the next stage (Havelock, 1973).

2.9.3 Stage three: Exploration and acceptance

During this stage, educators tend to get over the disturbance. They have stopped denying the change and the anger has, to some extent, dissipated. Educators now have an improved understanding of the change and are willing to explore further. They behave more objectively, and show interest in planning around the change (Havelock, 1973).

In conjunction with the change process, Fullan (2001) argues that consideration of the implementation of change is equally important (see Figure 2.11). Change consists of three stages: initiation, implementation, and institutionalisation (Fullan, 2001, p.50). The first stage, initiation, is the process that leads to the making of a decision to adopt the change.

The second stage, implementation, is the process whereby the idea is put into practice. The third stage, institutionalisation, is when the change is finally incorporated as part of the system - or simply disappears through attrition.

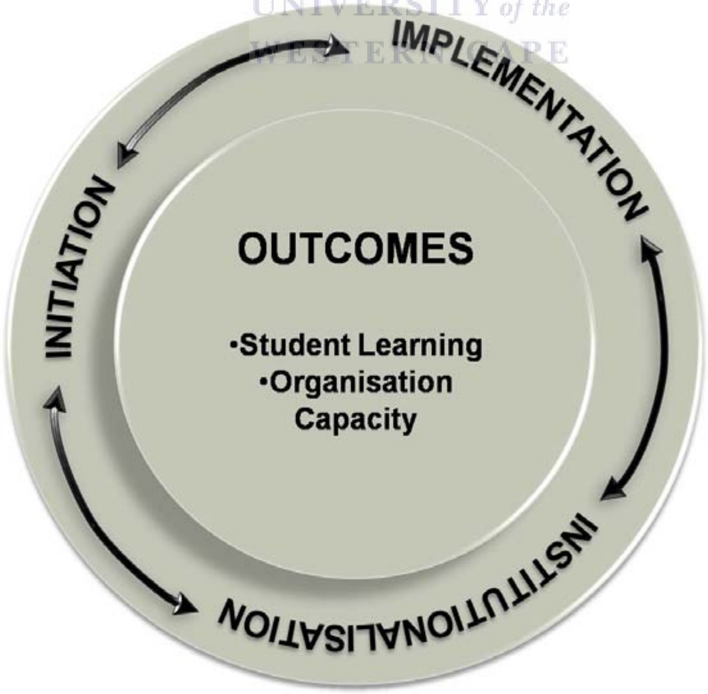

Figure 2.11: A simplified view of the change process (Fullan, 2001, p.51)

Fullan (2001) further states that active initiation and participation, support and negotiation, changes in skills and overriding problems of ownership – may all support the achievement of a positive or successful change outcome. Havelock (1973, p.6), indicates the next stages (see Figure 2.12) that an individual may follow, if and when he decides to act.

2.10 Havelock's educational models

Ronald Havelock, in his research, was more concerned with the dissemination of knowledge rather than with curriculum material. His concerns had to do with the various features of the 'change agent' - as well as with trying to explain how change occurred. It could be argued that the most primitive, but sometimes the most effective way to cope with change is to do nothing. "If ignored, it will pass." For example, if you are hungry, then you will eat. Havelock (1973) believes that most of the problem- solving behaviours in education are of this 'reflexive' trial-and-error variety.

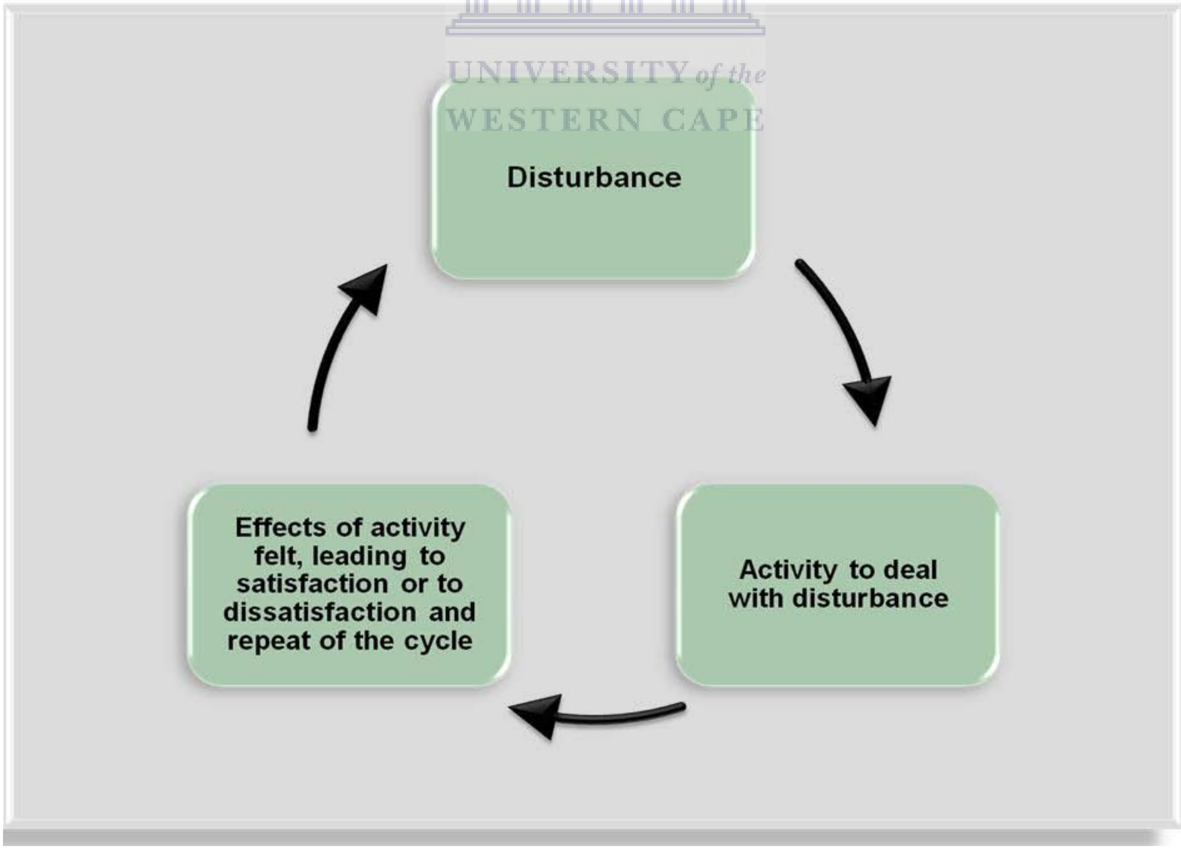

Figure 2.12: Change by simple reflex (Havelock, 1973, p.6)

In addition, Havelock developed four models: (1) Research Development and Diffusion model, (2) Social Interaction model, (3) Problem-Solving model, and (4) the Linkage model.

He did this in an attempt to map the different ways in which new knowledge is spread to those seeking to acquire it. Havelock (1973) later developed the concept of 'linkage', which focused on the individual as the true problem-solver.

2.10.1 The problem-solving model

The problem-solving model is based on the supposition that innovation forms part of the internal problem-solving process within the user. A more detailed and rational problem-solving model is given in Figure 2.13. It starts with an initial disturbance; thereafter it is broken down into four steps: (1) the user finds a need; (2) s/he diagnoses it as a problem; (3) s/he undertakes an investigation searching for solutions and (4) finally adopts and adapts a few solutions to see which one will most satisfy the need.

A concern about this model is what the user eventually does about the satisfaction of his needs, since this could end up as a repetition of the cycle.

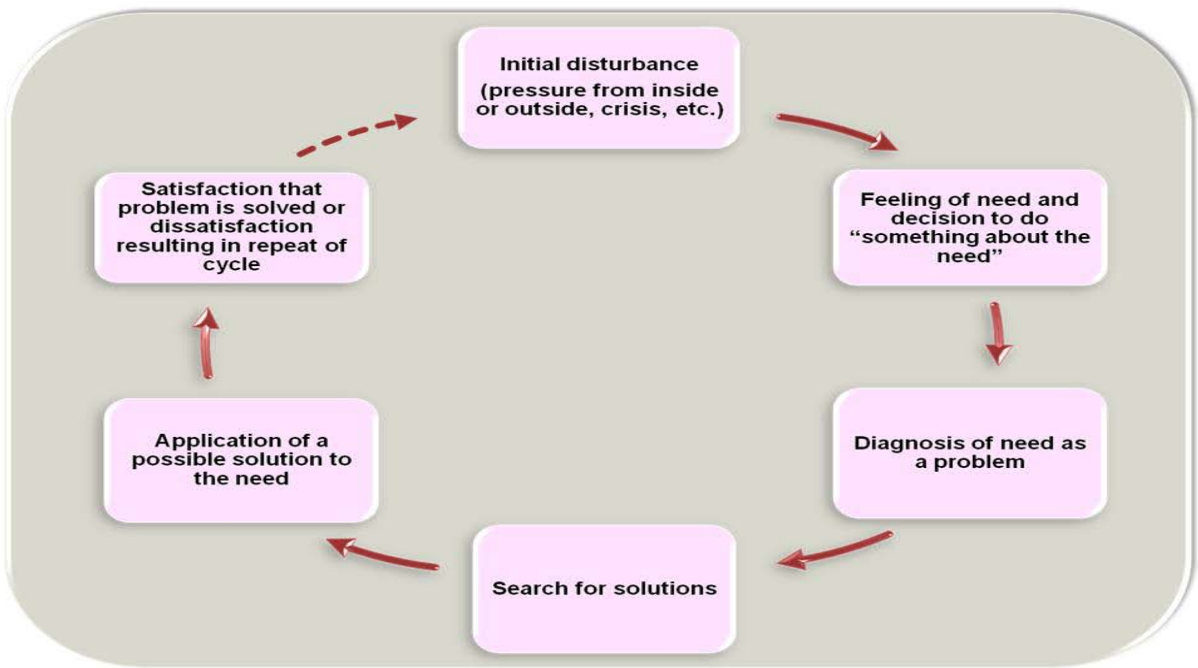

Figure 2.13: Change by rational problem-solving (Havelock 1973, p.7)

According to Havelock (1973), if outsiders are included in this problem-solving process (see Figure 2.14), then the role that outsiders play could be consultative or collaborative.

These outside change agents (i.e. people who are doing the changing) may provide fresh ideas and improvements to assist the users in solving their problems.

Moreover, he states that change agents or external consultants may provide guidance on the "process of problem-solving at any or all of the indicated stages" (Havelock, 1973, p. 155).

The problem-solving model has been strongly supported by social psychologists in the group-dynamics human relations tradition (Havelock, 1973).

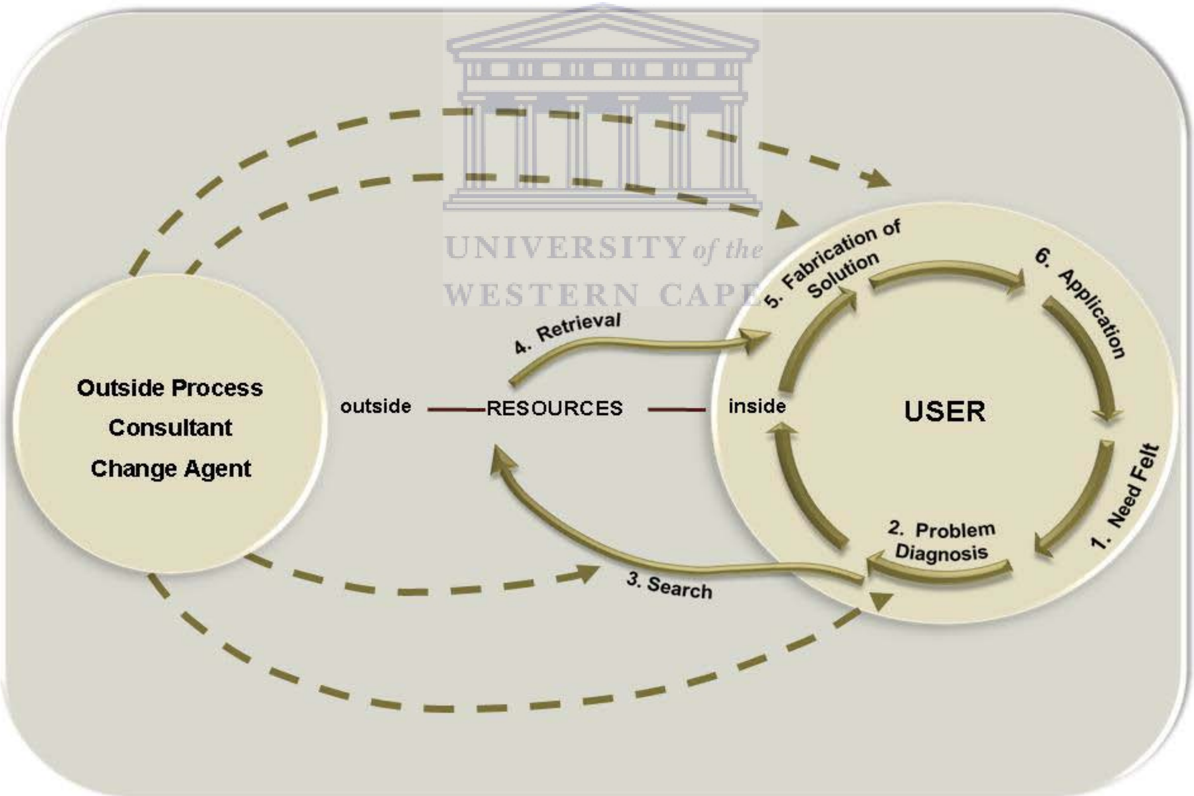

Figure 2.14: The problem-solving strategic orientation (Havelock, 1973, p.155)

This model, based on action research, uses a bottom-up approach. It is regarded as one of the more popular models in promoting change in educational systems (Markee, 1997).

According to Fullan (2001), educators often refrain from tapping into their school's knowledge database. In most cases this would be able to resolve the issue. Instead, they rather resort to imported knowledge. He states that educators must be more proactive in finding solutions to their own problems.

The strength of this model lies in the fact that the users of the innovation are responsible for identifying the needs of the educators. The role of the change agent in the model is important, as they provide guidance to the educators in solving their own problems. Havelock (1973, p.156) holds that "the outside change agent should be *non-directive*, rarely, if ever, violating the integrity of the user by placing himself in a directive or expert status".

If this approach is taken, it is likely that the innovation will be accepted. Furthermore, White (1988) cautions that heads of departments and educators can impose their own values on the school. Further strengths of this model are:

(a) It provides a structure for systematic re-examination of the present service-delivery system;

(b) It provides a framework for examining current procedures in relation to important educational decisions;

(c) The problem-solving model helps to communicate the 'why' of reform to the implementers and recipients of its services;

(d) The focus of this model is explicitly on 'decisions' to be made rather than on 'procedures' and provides a good strand for communicating the purpose of the change effort; and

(e) The problem-solving model provides a conduit for re-examining the education system by asking questions on how important education decisions could be made differently - and in a better way (Havelock, 1973).

A limitation of the model is that it does not consider the practical realities of schools.

The problem-solving model places tremendous emphasis on skills and relationships, which are unfamiliar in the prevalent school climate in many countries, including South Africa (Hord, 1987).

2.10.2 The social interaction model

The social interaction model views the user as being part of the network of influential social relations, and it emphasises the role of opinion leaders. This interaction model concentrates on patterns of diffusion and believes that information is a critical source of motivation to facilitate such innovation.

Havelock (1973) alleges that social interaction is not merely receiving from others, but also a matter of give-and-take.

As depicted in this model (see Figure 2.15), information on innovation is informally diffused from researchers to practitioners through a series of overlapping social networks.

The model assumes that most people are involved in social networks, which will have an influence on their behaviour. Thus, the main emphasis of this model is on adopter perceptions and characteristics, as well as on information diffusion.

According to Havelock (1973), many studies in this area have confirmed that an effective means of spreading information about an innovation is by personal contact. He suggests that the key to adoption is social interaction among members of the adopting group.

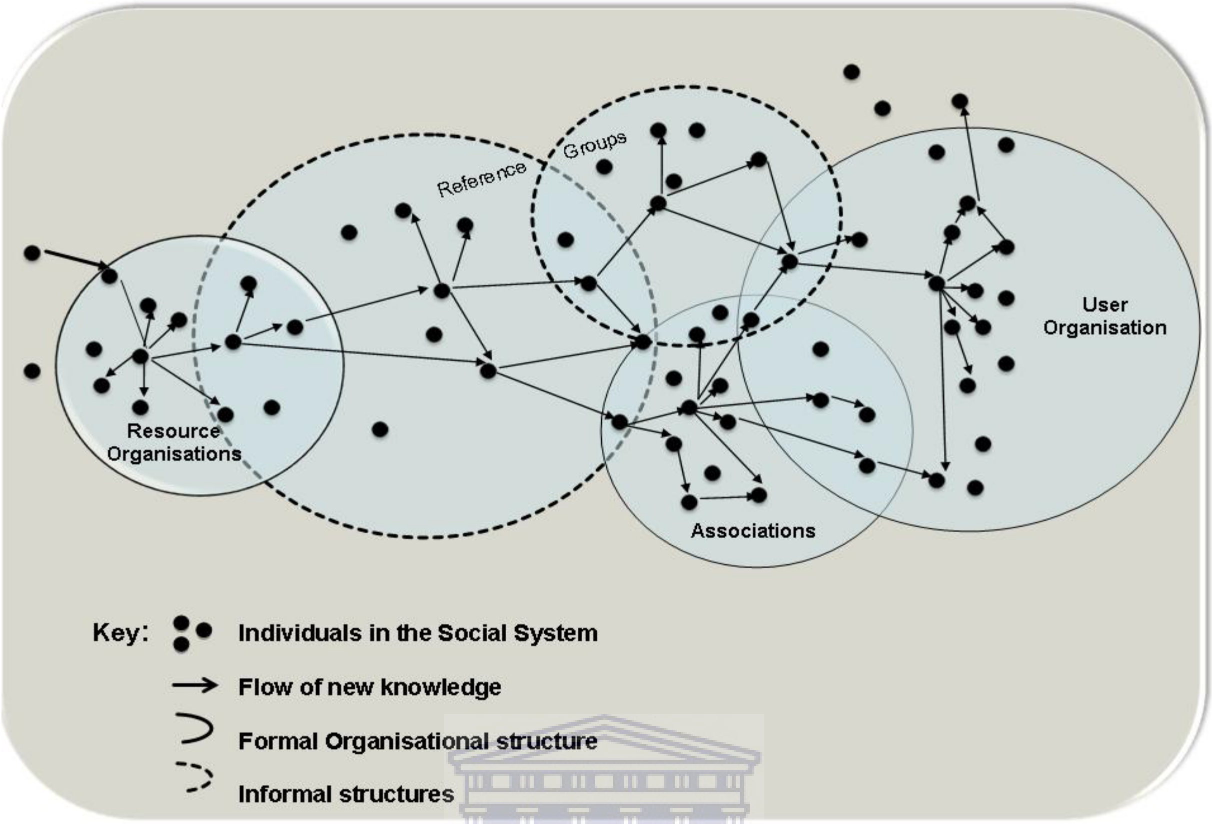

Figure 2.15: The social interaction perspective (Havelock, 1973, p.159)

The body of research that is associated with the social interaction model supports five generalisations about the process of innovation diffusion (Havelock, 1973, p.159). It assumes:

(1) That individuals belong to a network of social relations, which have an influence on their behaviour;

(2) That his/her place in the network determines the rate of acceptance of such innovations;

(3) That informal personal contact is a crucial aspect of the influence and adoption process;

(4) That group membership and reference group identification are major predictors of adoption for people; and

(5) That the rate of diffusion through a social system follows a predictable S-curve pattern, which is very slow in the beginning, but is followed by a period of very rapid diffusion, and then returns to a long slow period.

Furthermore, the model consists of five stages. Research has conclusively shown that most people go through the same adoption process (Huberman, 1973).

Awareness: The individual is exposed to the innovation, but lacks information on it, or may not be motivated to seek further information. The concept is that each individual in the system will go through the awareness-adoption cycle via a process of social interaction with his/her colleagues. This idea takes the form of convincing the educator of the usefulness of a new practice or tool (Huberman, 1973).

Interest: The individual searches for information about the innovation, but has not yet judged its value (Huberman, 1973).

Evaluation: This is the stage where the individual applies the innovation to his present and/or anticipated situation, and then decides whether to try it, or not. What is important in education is whether the educator is authorised to test an innovation (Huberman, 1973).

Trial: In this stage, the individual will use the innovation on a small scale in order to monitor its value (Huberman, 1973).

Adoption: If the trial stage is successful, then adoption will follow where the user will consider adopting, or possibly rejecting the innovation (Huberman, 1973).

The advantage of the social interaction model is that it places considerable emphasis on diffusion and the transfer of information in a social system. The role of early adopters plays an important function, as they have to be role models for the laggards.

A limitation of this model is that there is no continuity in the adoption process, as it stops when the person adopts the innovation, thus ignoring the actual implementation stage. Another shortfall of the model is that not much attention is given to the change agent.

2.10.3 The research, development and diffusion model

The research, development and diffusion model is a rational model that assumes a logical progression of goal-setting, planning, implementation and evaluation (Havelock, 1973). According to this model, innovation is seen as an outcome of research - developed by testing - and is therefore the result of prototypes. This model (see Figure 2.16) assumes that the consumer is a passive receiver and implementer of innovation that will conform to his/her needs.

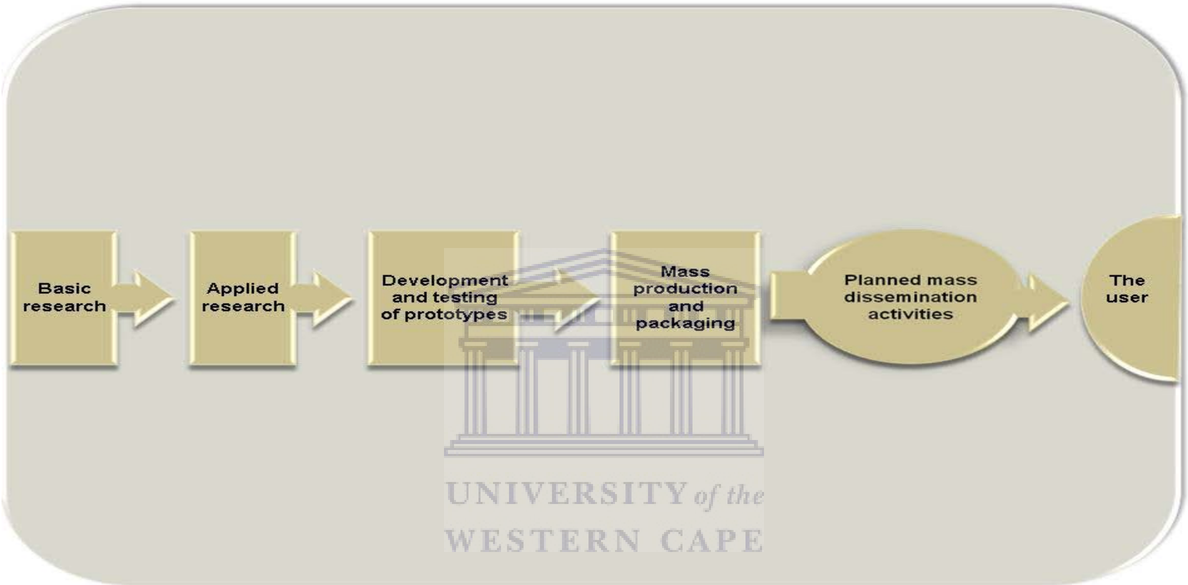

Figure 2.16: The research, development and diffusion model (Havelock, 1973, p.162)

In this model, researchers are the creators of innovations, while practitioners (educators) play a passive role in carrying out the directives and instructions. Furthermore, this model is normally implemented in large-scale, 'top-down' projects. An example of this is when the South African Department of Education decided to disseminate the new curriculum, OBE, on a nationwide scale. Huberman (1973) believes that the majority of models and strategies in education are based on the transfer from theory to practice. He hypothesises that change is an orderly sequence, starting with the identification of an idea, proceeding through the development of prototypes, and then ending with the diffusion of the product to the receiver system. Furthermore, he argues that the emphasis of the research, development and diffusion model is planning for change on a big scale.

The four steps in the model are research, development, diffusion and adoption. These, in turn, are divided into sub-tasks with specific objectives. Havelock (1973) summarises the major characteristics of this model as follows:

Firstly, the model assumes that innovation is a rational set of activities. Secondly, the model implies planning on a large scale over a long period of time. Thirdly, the model requires a passive consumer who is willing to accept and adopt the innovation. Finally, the model has high initial developmental costs; but it is rewarded by long-term benefits, such as efficiency, quality and capacity.

The advantage of the model lies in the huge scope of development and diffusion. This implies that well-designed innovations could successfully be delivered to large groups of people and institutions (Maciel, 2001).

A limitation of this model is that it underestimates the various stages of diffusion and adoption and assumes that practitioners and institutions will adopt the innovation *ipso facto*. The model requires a sophisticated co-ordinating agency, as the tasks outlined in the model will be extremely difficult for any one country to perform (Havelock, 1973). Notwithstanding its status, this model is open to criticism because it pays inadequate attention to the execution process. The failure of this model to effect changes can best be illustrated by the major underlying assumption that innovations will be adopted by passive end-users. Instead, research indicates that educators should be allowed to experiment with the innovation before being obliged to adopt it (Fullan, 2001). Research also suggests that the adopters be included in the decision-making process to adopt or reject the innovation (Huberman 1973). These strategies are conspicuously missing in this model.

Other research has sent mixed messages about the efficiency of the Research, Development and Diffusion model. A study by Hadley and Sheingold (1993) investigated the integration of computers into educator's lesson-delivery. It found that attitudes towards an innovation are an important variable that affects its rate of adoption. These findings tend to reject the Research, Development and diffusion model's assumption that potential adopters are passive in the adoption process.

2.10.4 The linkage model

Havelock (1973) developed the linkage model to address some of the shortcomings in his previous models (see Figure 2.17). He advocates that the adoption of an innovation should be seen as a linkage process, but cautions that it should not be taken “merely as a two-person process”, as the resource person must have access to additional resources (Havelock, 1973, p.165).

The linkage model is a process where people within their own systems, play specific roles. The model consists of two systems: (1) The user system, and (2) The resource system. The ‘user system’ is the person who is attempting to adopt an innovation, while the ‘resource system’ is the person who is trying to get others to adopt the innovation.

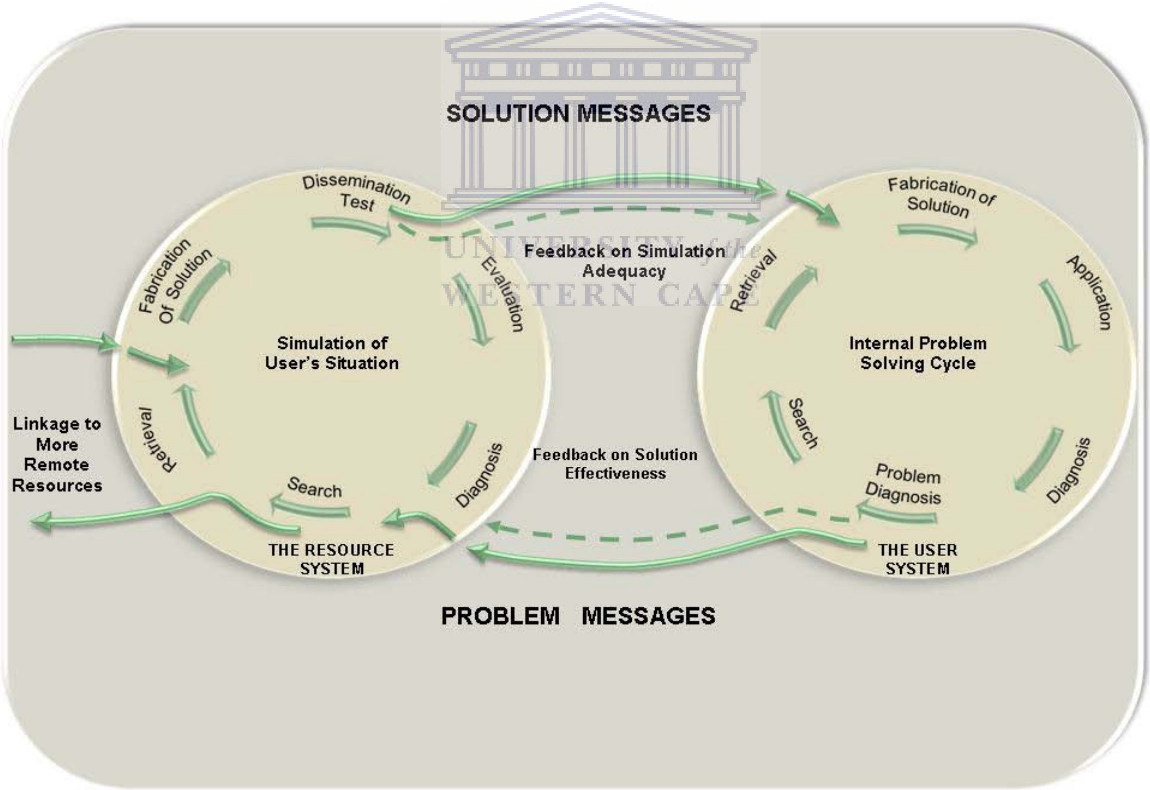

Figure 2.17: A linkage view of resource-user problem-solving (Havelock, 1973, p.166)

Havelock (1973) firmly believes that the user must forge strategic alliances with outside resources so that ‘reciprocal relationships’ can be developed. Furthermore, he argues that in order to assist the “internal user problem-solving activities, the outside resource person (or system) must be able to recapitulate or *simulate* that internal process” (Havelock, 1973, p.165).

To explain further, it is necessary for the resource system to receive feedback from the user system through a process of simulation. The simulation process must include all the phases that the user system has gone through. Simultaneously, the user system must have sufficient understanding of how the resource system works. The linkage model consists of five key aspects.

The first involves user problem solving and the recognition of users to assist in the distribution and execution of their activities.

The second aspect concentrates on the mechanisms for regularly determining users’ needs and for transforming these needs into problem statements. The third aspect has to do with performing research at the critical time for users, while the fourth is producing solution conduits.

Finally, there is a drive to create a working base so that users and researchers can work together (Havelock, 1973). An advantage of this model is that it utilises the services of change agents or external resources. These are people who are specialists in their fields of work, and are crucial elements in motivating the process of change.

A limitation of the linkage model is that it does not pay attention to the barriers that may act against the users’ will-to-change. It is too narrow in scope and too far removed from the realities of many schools. A possible reason could be that the change process needs a link to additional resource people - thereby creating a chain of ‘knowledge utilisation’ in schools (Havelock, 1973).

2.11 Summary of the educational innovation theories

This section has indicated that there are several models and theories of educational innovation. Each of the models has its own epistemological assumptions on educational change and knowledge.

Only some of these models will work well in some countries, and not so well in others due to differences in educational policies, political situations, and educational and environmental issues. Several models can, however, be combined to extrapolate their benefits optimally, while avoiding their weaknesses. Innovators should do so judiciously. The models have indicated that for any planned innovation to succeed, educators must be actively involved in the planning, designing and implementation stages. Educators who show resistance to new computer innovations are passive, resistant, or dysfunctional (Havelock, 1973; Huberman, 1973). The reason for this diversity of reaction is that some technology characteristics are treated as constants rather than as changing over time.

Some models failed to include characteristics of the organisational environment and social interaction that could have had an impact on the outcome of the technology innovations. However, there were models, such as the Diffusion of Innovations and the Technology Acceptance Models that had contributed to the adoption of educational innovations. Furthermore, these models may actually have assisted educationists in the development of strategies to implement their computer innovations. The theories and models discussed in this chapter provide a solid foundation in the collection of data for this research. By using, a variety of educational change models there is the underlying assumption of an increasing success rate in implementing change in the educational system.

In addition, these models have assisted in creating a culture of accepting change and innovation.

The next chapter will examine the empirical evidence found in the literature that encourages the use of computers for instructional purposes.

CHAPTER 3

COMPUTERS AND EDUCATION

3.1 Introduction

The use of computers in curricula is an expensive and at times a complicated process. It demands the necessary computer hardware, software and resources, including competent educators and support to ensure its success.

It has been observed that technology has been influential in the development of modern society. Technology has also infused into the discipline of education and has affected the teaching and learning processes. Therefore, it is expected that educators today should be technologically literate by integrating the use of computers into their instructional methods in the classroom.

This chapter contains an extensive literature review on the use of computers by educators for their teaching purposes. In addition, it highlights what is currently being done regarding the use of computers in education, and what progress has been achieved in this domain. Chapter 2 accentuated the importance of using a comprehensive framework to understand and explain the complexities involved in getting educators to alter their teaching practices.

Chapter 3 engages with the literature on how some of the technological and educational models discussed in Chapter 2 have been used in previous studies. Moreover, this chapter draws on a wide selection of research studies to facilitate a more comprehensive discussion of the factors that promote and those that hinder the use of computers in the classroom.

Chapter 3 further discusses the role of technologically innovative teaching strategies, as well as the impact of computers on learners and educators, and in particular the lesson delivery by the educator, in order to assess the advantages and disadvantages of computers in education.

Pope (1999, cited in Pope and Golub, 2000, p.93) exhorts educators and learners to become critical users of technology. He insists that users be thoughtful consumers "who question, reflect and refract" on the most efficient means to integrate computer technology. Therefore, in order to become recipients of this process, educators must become critical evaluators of their methods of lesson delivery in the classrooms.

The question of why the incorporation of computers into the classrooms had been so slow is answered by Fuller (2000) who points out that the introduction of computers into classrooms has placed many educators in a dilemma. The scholar states that the integration of computers into the curriculum was poorly planned and educators were poorly trained. Many educators do not understand the role that computers should play, and educators have often felt threatened by the possibility of being replaced by computers (Fuller, 2000).

This chapter therefore seeks to find solutions to the research questions presented in Chapter 1. The research questions are:

1. Do educators' beliefs have any impact on computer usage?
2. Do secondary school educators have the necessary access to computers?
3. What factors determine the educators' pedagogies of computers for teaching purposes?
4. What is the impact of educators' attitudes towards using computers for teaching purposes?
5. What support do the educators receive to use computers for pedagogical enhancement?
6. Does training make a difference in the level of computer use by educators?

The chapter commences with a discussion of the relevance of computers in education. The key determinants in the theoretical framework that influence the use of computers by educators will be proposed and discussed, and then the research hypotheses will be generated.

3.2 Theoretical framework

Sekaran and Bougie (2010, p.80) state that the theoretical framework is “the foundation on which the entire research” rests. They believe that where a researcher has made use of existing theory to formulate research questions theoretical propositions could be used as a means to devise the necessary framework. In other words, this is a conceptual model of how a researcher makes logical sense of the relationships between factors that have been identified as important to the research problem.

In the words of Hussey, J and Hussey, R (1997, p.123), “A *theoretical framework* is a collection of theories and models from the literature which underpins a positivistic research study”. The creation of these theoretical frameworks assists researchers in testing certain relationships, thereby improving the understanding of the situation. Once the theoretical model has been constructed, hypotheses can be developed to test whether the theory formulated is correct (Hussey, J and Hussey, R 1997).

A theoretical framework further identifies the salient variables that are pertinent to the research problem, as well as describes the interrelatedness among the variables (Saunders *et al*., 2003). According to Sekaran (2003, p. 87), “a variable is anything that can take on differing or varying values”. The four main types of variables are the dependent variable, the independent variable, the moderating variable, and the intervening variable. In this study, the dependent and independent variables were considered. The dependent variable is of main concern to the researcher, as it is the researcher’s goal to understand its variability. In Sekaran’s words, “it is the main variable that lends itself to investigation as a viable factor” (Sekaran, 2003, p.88).

Attention will be directed to the constructs based on the literature arising from the prominent theories and models presented in Chapter 2 in combination with the empirical findings from previous research projects.

The review begins with a justification and an explanation of why these constructs have been integrated into the proposed research design.

It will also examine technological trends in education and the use of computers as teaching and learning tools. The second section elaborates on Rogers' (2003) diffusion of innovations theory, which provides the theoretical framework for this research.

3.3 Technological developments in teaching and learning

Researchers have spent many years investigating how computer technology has affected teaching and learning in schools. There were four leading waves in the coming to fruition of computers in education, and each of the waves introduced a new dimension of teaching and learning with computers (Pownell and Bailey, 2002).

The first wave of technology involved very big and expensive mainframe computers that were mainly used as an administrative tool (Pownell and Bailey, 2002). Later, as the advancement in computer technology increased, mainframes were used in educational institutions for computer-assisted instruction, tutorials and educational games (Logan, 1995; Gignac, 2005).

The second wave of technology consisted of desktop computers, more powerful and smaller, which became available to educators in 1970 (Pownell and Bailey, 2002). The authors agree that the advances in the development of the microchip made the processing power of personal computers more powerful and they soon became quite popular in schools. Consequently, the use of word processors, spreadsheets and databases became the "standard uses of computers in schools and homes" (Pownell and Bailey, 2002, p.50).

The third wave of technology consists of the internet and the World Wide Web (Pownell and Bailey, 2000). The internet allows cost-effective information delivery services, ubiquitous, collaborative and "autonomous learning", and has exerted a tremendous impact on education, more than had ever been imagined (Todd, 1997; Johnson, Chapman and Dyer, 2009, p.136).

The past president of South Africa, Mr Thabo Mbeki, stated that technology-enhanced learning could make education more interesting to learners.

He stated that the internet and the World Wide Web "offer an immediate and inexpensive opportunity for schools" (Mbeki, 1996, p.37).

According to Pownell and Bailey (2002), the use of the internet in schools can be a natural source to provide the missing link between educators and information resources.

Computers are increasingly used in the classrooms, as these allow educators to deliver lessons more creatively and to use tools that extend the quickest methods of learning in an interactive atmosphere (Saheb, 2005).

The fourth wave of technology concerns the use of wireless technology and devices: iPods, podcasts, cellular phones and hand-held computers (Pownell and Bailey, 2002). According to Kekwaletswe (2007), this could be described as ubiquitous computing where educational tools can be transported anywhere, any time and any place in an educational environment.

Contrary to all of the above, Gordon (1997) questions whether the problems faced by education in South Africa could be solved by the inclusion of computers into the classroom. He argues, moreover, that computer-based education is still unproven in the developed world, and should not be the type of technology that should be high on the list of a developing country's educational priorities.

Notwithstanding the above, Lim and Chai (2008) categorically state that computers as pedagogical tools offer many advantages over traditional methods of teaching and have made it more dynamic and complex. Other researchers (Sang, Valcke, van Braak and Tondeur, 2010) support Lim and Chai (2008). They maintain that computers are important tools in education, supporting learners with tutorial activities, guiding discovery learning and building intellectual structures.

The literature has provided some evidence that educators believe that computers have the potential to change the way they teach and learners learn, thereby improving the quality of education. Another way of improving education that has been perceived as a viable education system over the past few decades is Outcomes-Based Education (OBE).

3.4 A brief background to outcomes-based education

After the elections of the democratically elected government in 1994, Outcomes-Based Education (OBE) was launched in 1996 as a curriculum transformation strategy.

The primary goal of this policy was to change the legacy of apartheid education and training with a view to equipping learners with skills, knowledge and competencies required in order to be successful in the current workplace. In South African schools, Outcomes-Based Education has been implemented through Curriculum 2005. According to William Spady (1994, p.130), who is regarded as the original OBE theorist, Outcomes-Based Education ensures - through its inclusive approach - that "all students can learn and succeed" on different days and in different ways. Spady is of the opinion that OBE is a single system of education where all learners can learn - each at his/her own pace. Therefore, for any system to be inclusive of all learners, more time and support is required in order for it to be successful.

It is educators, in this instance, who need the support, as they would be exposed to multiple intelligences, such as co-operative learning, teaching with computers and using various other learning techniques. In the past, not all educators were responsible for dealing with slow learners. The new system, however, now requires that all educators must be able to deal with all categories of learners. The Curriculum 2005 framework changes some of the traditional methodologies in teaching:

- From text-book to work-sheet bound;
- From teacher-centred education to learner-centred education, where the educator facilitates the learning process;
- From formal examination-based assessment to continuous or ongoing assessment;
- From non-participating or passive learners (i.e. where learners listen and take notes) to active or constructive learners (i.e. where learners participate in the learning process through group discussions or interaction with the educator);
- From content-based education to Outcomes-Based Education; and
- From rote learning to analytical and critical thinking, reasoning and reflective learning.

3.4.1 Outcomes-Based Education and computers

Chien-Sing (1999) argues that when learners construct their own knowledge it becomes more meaningful. In educational terms, this is known as 'constructivism'. If learning is a constructive process, then the present curricula must be designed in such a way that they provide opportunities for such construction. Accordingly, Solvie and Kloek (2007) believe that the use of computers in education is an example of a constructivist process.

Therefore, if educators use computers for teaching they will enhance their potential to improve multi-perspective and self-directed learning. Thirty-one years ago, the erudite scholar Joseph Novak, in 'A Theory of Education' (1979), strongly believed that computer-assisted instruction would augment the positive drive towards a better learning approach; however, he warned of the costs of doing so. In addition, he was concerned about whether, as computer technology influences education, the role of the educator would still remain viable in years to come.

The use of computers in education (see Figure 3.1) can be divided into four categories, namely: educational research, administration, teaching and learning, as well as other purposes (Mostert, 2000). Furthermore, the scholar makes a distinction between computer-assisted education and computer-managed education - where the latter is about managing the learning and teaching environment. Mostert states that certain software tools and multi-purpose programs can assist the educator in computer instruction in the classroom. Simulations on computers can now be used to present information and the learners can use such simulations for drill and practice.

Furthermore, educators have stated that their use of computers does have a positive impact on learning outcomes (Miller *et al*., 2006b; Chigona and Chigona 2010). However, with innovation, there are always a few concerns, and these will now be discussed.

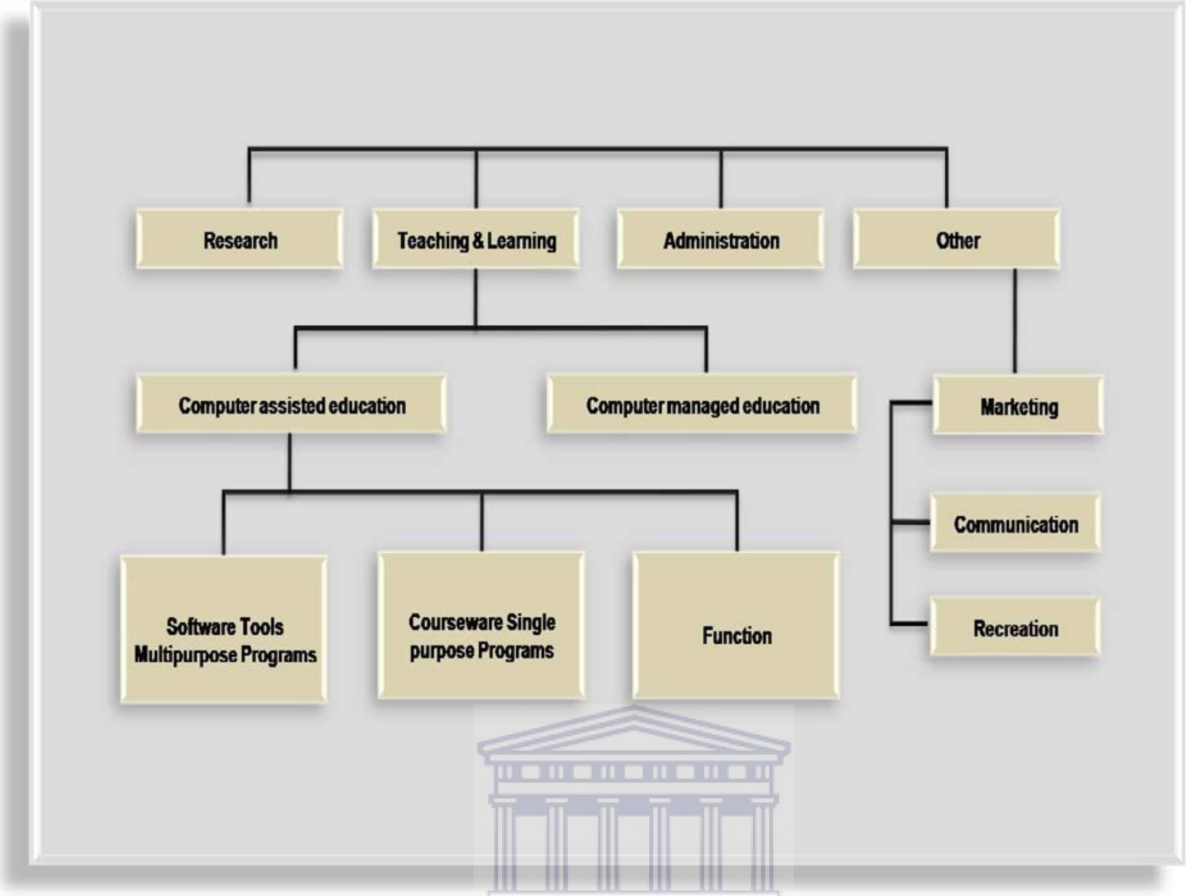

Figure 3.1: Computers in education (Adapted from Mostert, 2000, p.34)

3.5 Educator concerns

Due to the level of training that educators receive, the implementation of technology integration into the curriculum has been a tedious task (Vannatta and Beyerbach, 2000). They assert that the educators who learnt computer technology applications by themselves may not be as effective as those who have received professional training for their particular teaching needs.

According to Vannatta (2000), technology courses may assist educators to develop basic computer skills. Educators, however, are not sufficiently prepared to use technology in the various instructional environments.

Bryant (2001) posits that investments in computer technology will be unsuccessful if educators do not receive the necessary support and training to assist them in utilising computers effectively as a teaching medium.

It is worth noting that the U.S. Department of Education (2002a) is of the view that educational improvement programs, which use technology for teaching and learning, will produce positive results for educators and learners. They believe that the future for education could be quite bright if the nation maintains its commitment to harnessing technology for education.

In a similar vein, Jonassen (1999) asserts that computer technologies are changing the educator's role from information-giver to learners to facilitator, counsellor, advisor, mentor and technology managers. He argues that the use of computers in education is steadily becoming an important aspect of technology education and these innovative methods will help educators with a sound educational platform to apply constructivist-learning theories. In order for children to become computer literate, parents in developed countries have pressurised the education administration to make computers part of the curriculum. Some reasons for the implementation of computer technology in education were:

- Educators' professional development in using computers for instruction during their training was generally considered essential for school effectiveness and improvement (Ololube, 2005);
- Educators who were determined to increase their computer competences were likely to contribute directly or indirectly to the escalation of the learners' achievements (Creemers, 1994);
- Providing ICT policies for authentic teaching: using computers in the classroom improves subject-matter teaching and learning (Otero, Peressini, Ford, Garvin, Harlow, Reidel, Waite, Mears and Meymaris, 2005);
- Preparation of learners to actively engage in computers by acquiring the basic computer literacy skills, such as word-processing, spreadsheets and online support (Duggleby, Jennings, Schmoller, Bola, Stone, Willis and Pickering 2004);
- Cognitive skills: computers will assist learners by developing cognitive skills, analytical and critical thinking and collaboration. It is believed that computers can assist students by releasing them from monotonous paper work, thereby motivating them to learn, and in the process they become engrossed in using their computers (Miller *et al.*, 2006a); and

- Teaching becomes more interesting: computers allow the educators to become more creative in delivering lessons, so they can vary their methods, moving away from the traditional teaching approach (Miller, Naidoo and Van Belle, 2006b).

Evidence from the literature indicates that using computer technology for teaching purposes in the curriculum is initially a difficult task for educators to implement. There is a need for educationists to develop a model or program to assist educators in their use of computer technologies. Computer use can contribute as a teaching aid and support tool and it may help learners become less dependent on the educator as the expert (Jung, 2005; Strydom *et al*., 2005). The WCED realised that the use of computers has the potential to improve teaching and learning and has therefore implemented the Khanya project. This will now be discussed.

3.6 The Khanya project

From 2002 to 2005, members of the Khanya project installed computer labs in 845 schools and were hoping to complete the implementation of computer technology in all schools in the Western Cape by 2012. Established in 2001, the Khanya project aimed to address the shortage of educator capacity in schools using computer technology (Khanya, 2006). The main objective of the Khanya project was to create a technology-rich province, thereby narrowing the digital divide and harnessing the power of technology to deliver a curriculum and to improve the quality of learners' results. However, it had no intention of replacing educators with computer technology (Khanya, 2006).

The very ambitious goal of the Khanya project was that, by 2012, every educator in the Western Cape would be empowered to use the appropriate technology available to deliver the curriculum to learners. According to WCED (2009), only a few public schools in the Western Cape prior to 2002 had some form of computer technology that educators and learners could use. Through information elicited from a personal interview, Pearce (2008) indicated that only some of the 1816 educators in the Western Cape central metropole were computer literate, and only a few educators used computer technology in their classrooms.

He stressed that the Khanya project was not intended to make educators and learners computer literate, but rather to use technology to improve the delivery of curricula. This study has been conducted in the Western Cape central metropole and a brief description of how these districts evolved will be given next.

3.7 Western Cape education districts in brief

The Western Cape Education Department (WCED) has eight education districts, divided into 49 circuits, following a major redesign process in July 2006 (WCED, 2009). The reason for the circuits is to bring professional support closer to schools through strong circuit teams. The eight education districts were created to facilitate an integrated approach to education management. Figure 3.2 below depicts the demarcation of the districts.

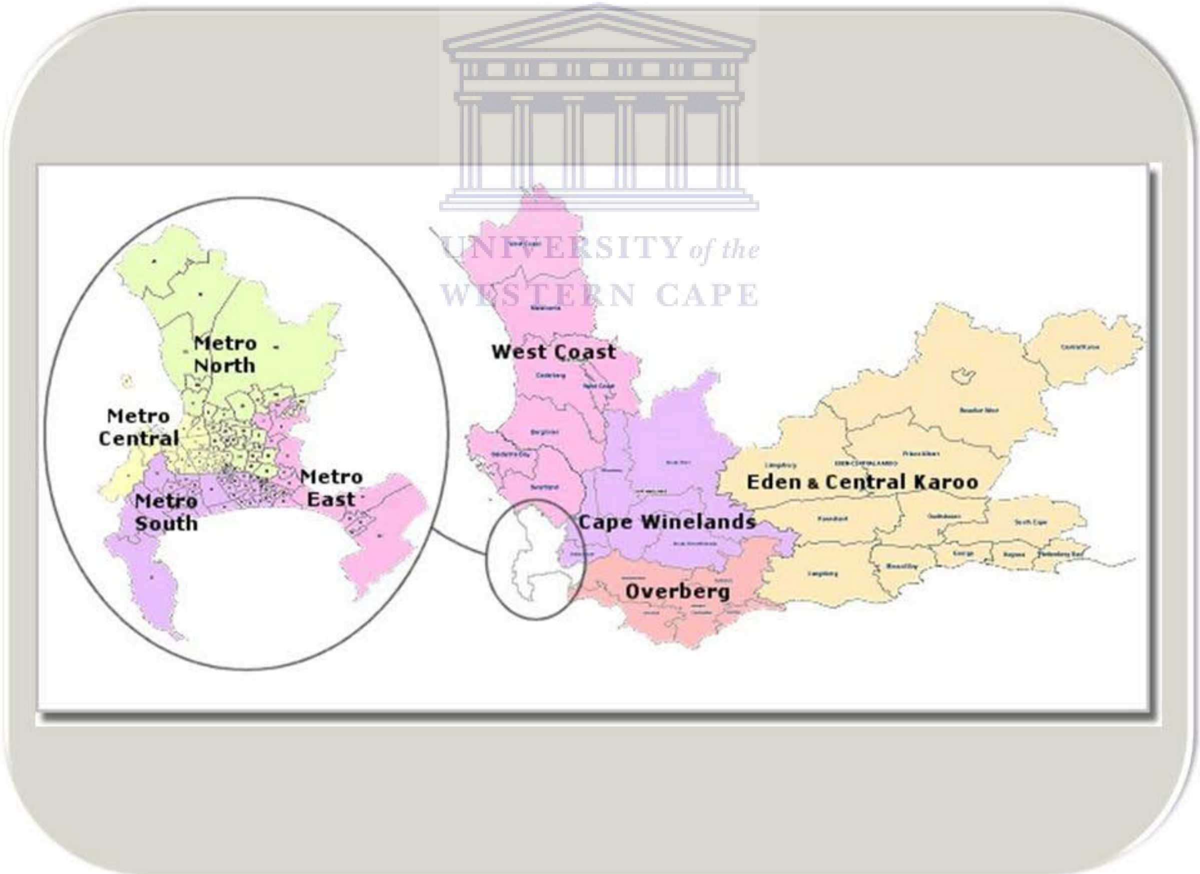

Figure 3.2: Demarcation of the education districts in the Western Cape

3.8 Parent and stakeholder concerns

Resistance to change is a factor that will consistently prevent educators from using computers in their classrooms. According to Cox, Preston and Cox (1999), educators who are not aware of the potential benefits of using computers in their teaching are less likely to make use of computers. As a result, parents and school-governing bodies are concerned and are raising questions such as: Do educators have the relevant skills for the successful implementation and use of computer systems in schools? Do educators have the confidence based on familiarity with computer systems to integrate the use of computers into their teaching? Stakeholders have the right to enquire whether the Khanya project has reached its objectives; and what the extent of the impact was.

Accountability to taxpayers and political and financial pressure, as well as the need to justify the spending of public funds, have thus led to increased pressure by parents, educators and school-governing bodies regarding the use of computers for teaching in schools (Lundall and Howell, 2000; Miller *et al*., 2006b).

3.9 The role of computers and educators in education

The objective of this study is to investigate the level of computer use by secondary school educators in the Western Cape central metropole and to provide practical solutions aimed at achieving higher rates of computer usage for teaching purposes. A UNESCO report on curriculum and educator development suggests that ICT integration is “using computers for instructional purposes” rather than “learning to use computers” (UNESCO 2004, p.45).

As noted by Roos (2005), computer use for teaching will only be successful if educators have the ability to set assignments for learners that require them to use these computer skills. He continues by saying that computer use in the South African context would assist educators to engage in new instructional techniques that are outcomes-based.

The literature indicates that researchers may not have adequately investigated factors that create high levels of computer use. Research in this area is vitally important to understand what the barriers are.

In addition, many studies in schools have focused on ‘learning about computers’ rather than learning ‘with’ or through the ‘use’ of computers (Jonassen, Peck and Wilson, 1999).

According to Pelgrum and Anderson (2001), governments in various countries have invested huge amounts of money in computer hardware and software, resources and educator training with a view to improving educators’ teaching and learners’ learning. In spite of these investments, they argue that the integration of computer use in education has been quite inadequate.

As noted by the British Education Communications Technology Agency (Becta, 2005), this evidence agrees with the fact that the implementation of computer uses in schools is not an easy task; because there are many barriers and obstacles that must be overcome before it is possible to speak of a ‘successful implementation.’

As mentioned earlier, one of the most widely quoted authors in the field of specialisation of education and curriculum innovation, Fullan (2001) is of the opinion that the role, which educators play in the implementation phase, is quintessential because educators are responsible for deciding whether to implement the innovation. Moreover, he argues that in order achieve the benefits of the desired outcomes, changes in educators’ beliefs, attitudes and behaviour must be addressed.

Evidence from research conducted in South Africa by Lundall and Howell (2000), ‘Computers in Schools’ indicates that only a small number of educators then used computers as an integral part of their teaching. Similar results were obtained from studies conducted in the USA and in London where educators were not utilising computers to their fullest capacity (Cox, 2000).

By contrast, a later study in the UK by Duggleby and others (2004), revealed that in the case where more than 5000 educators and teaching assistants had training in computer skills, the educators achieved outcomes which far exceeded any initial expectations. In that study, the use of action plans had encouraged schools to focus and plan ahead regarding their ICT strategy.

A few studies, which investigated the use of computers in education, revealed that it was the educators who were instrumental in influencing this process. The Lundall and Howell (2000) study found that it was the positive attitudes and access to training that had contributed to the use of computers in schools. Other studies (e.g. Finley and Hartman, 2004; Venkatesh, 2000; Butler and Sellbom, 2002) found that knowledge, skills, beliefs, ease of use and support were just as important.

In similar vein Plomp, Brummelhuis and Pelgrum (1997) pointed out that there is no single factor in the introduction of technology for education that determines the integration of technology. They are of the view that there are factors that may differ, depending on the stage of the technology implementation process.

As was discussed earlier, the literature on educational innovation indicated that the role of the educator in curriculum innovation is a key factor. According to Becta (2005), the implementation of computers in education is a complex process and has not been successful at the educator level. They argue that educators have made little progress in using computers more frequently in classrooms because there are barriers that are hampering this process.

The literature on the uptake of computers in education accentuates the point that the educator is the most crucial factor in the process of innovation (Cox and Rhodes, 1998; Afshari, Bakar, Luan, Samah and Fooi, 2009). In order to understand why the use of computers has been so limited, Rogers' (2003) Diffusion of Innovation Theory will be used as a theoretical framework to gain insight into these barriers.

Rogers' model has been used in many studies on instructional technology. It will be further explained in Chapter 4.

3.10 The use of computers in secondary schools

Pelgrum and Schipper (1993) stated that the use of computers plays three main roles in schools. They can be used as an object of study, which refers to learning about computers. In this role, students learn about the computer and are taught computer literacy skills and the use of computer applications (Becta, 2004).

The intention behind exposing students to computers is to combat computer illiteracy in schools. Computer literacy is the ability to recognise computers, their capabilities, their strengths and weaknesses and the skills needed to deal with computers.

In the second instance, the use of computers in schools is a tool for teaching and learning. Ward and Parr (2010) believe that computers are used to supplement regular classroom lessons and to assist educators by providing individualised assistance to students. The literature suggests that the use of computers in education acts as an excellent teaching tool (Fullan, 2001; Cox, 2000; Fuller, 2000).

In the third instance, computers are used in schools for administration, communication to parents and management (Howie *et al*., 2005). Educators and principals can ease their administrative duties by using special software. In addition, tests can be designed and administered to students electronically; class registers can be kept electronically and student progress can be monitored through the use of computers.

The brief discussion about the use of computers in secondary schools suggests that computers have a pivotal role in facilitating teaching, administration and management responsibilities in schools. However, there is a danger that computers are being used primarily for administrative duties, instead of instructional uses (Howie *et al*., 2005).

3.11 Factors affecting the use of computers in education

There are factors that accelerate the use of computers in schools, and there are factors perceived by educators that invariably inhibit computer innovation in education.

The inhibiting factors are *inter alia* the changing policy environment, school administration, the advances in computer technologies and educator-related issues. A survey of ICT integration in South African classrooms found that a lack of access to the necessary software, a shortage of time and lacking support were some of the factors which prevented the use of computers in classrooms (Strydom *et al*., 2005).

Furthermore, the report found that 75% of educators responded that the necessary computers which had to be used during lesson delivery, were unavailable (see Figure 3.3).

Lundall and Howell (2000) supported Strydom and others (2005) in their contention that the lack of computer resources was especially familiar to educators who taught large classes.

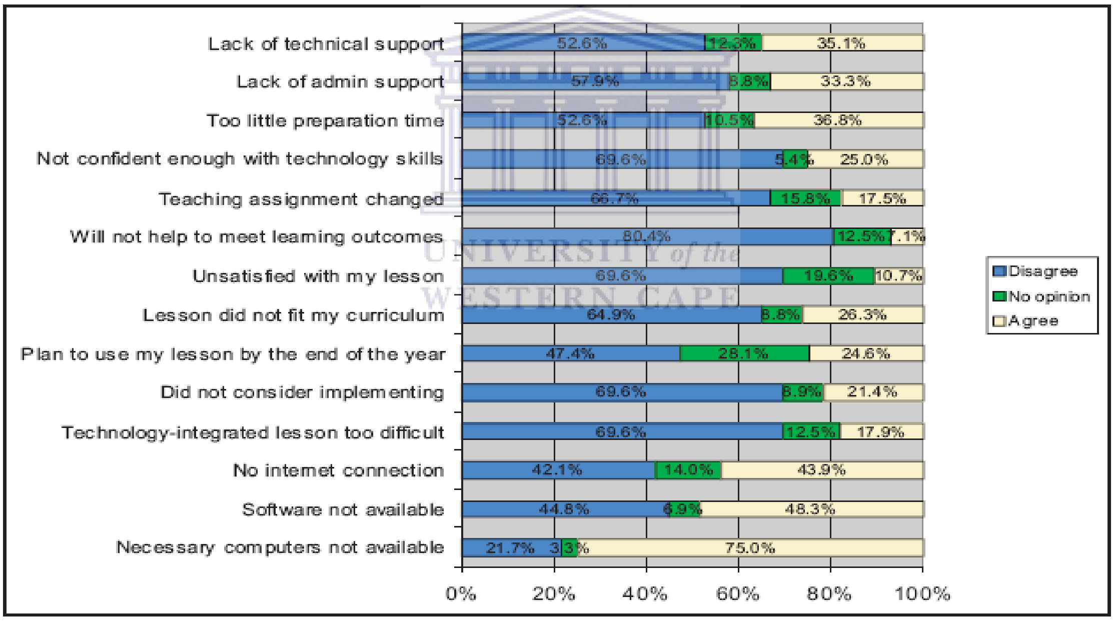

Figure 3.3: Reasons for not implementing technology-integrated lessons (Strydom *et al*., 2005, p. 79)

3.12 Technology adoption factors in education

The impetus to use computers during lessons is adversely affected by several constraints, such as a lack of time to increase confidence, limited access to computer resources and a lack of support. It can be argued that computers can be deployed in diverse ways to support educational goals.

Existing constraints, however, have increasingly stifled educators regarding the use of computers. In Chapter 2, factors that influence or hinder the use of computers in education were highlighted. Researchers have listed these factors under various names.

Scrimshaw (2004) defined ‘individual’ and ‘school’ level factors as ‘enablers’ which supported the operation of ICTs in schools.

Cox and others (1999) classified factors into ‘positive’ and ‘negative’ factors’. Fullan (2001) used factors such as ‘access’ and ‘change agents’ indicating relationships required to initiate decisions. Jones (2004) advocated that adoption factors could be defined along two levels, namely the educator and the school.

Educator-level factors are those that relate to educator skills, understanding the use of technology and the perception of the use of computer technology in schools (Miller *et al.*, 2006a). In addition, these scholars state that school-level factors are external factors, such as leadership, cost and infrastructure that contribute to the successful implementation of an innovation. In their study that comprised educators and principals of selected schools in the Western Cape, the researchers found that factors such as accessibility to ICTs, lack of resources, technical support and influence by educational leaders played important roles in the use of computers for teaching in classrooms. The Miller and others (2006a) study concluded that the benefits of using computers in education would only be realised if educators were willing to adopt computer technology at a higher adoption rate and have a better understanding of the above factors.

In the computer literature, many reports have suggested that computer hardware problems, quality of software, insufficient time and a lack of training are seen as the common barriers to the use of computers (Jones, 2004; Howie *et al*., 2005; Afshari *et al*., 2009; Lundall and Howell, 2000). However, it would be wrong to assume that by eliminating these barriers, there would be a smooth transition to computer use in the classrooms. Personal issues such as educators’ behaviour, their attitudes and anxiety in regard to computers also need to be considered (Mueller *et al*., 2008; Molope, 2006).

The South African government, seeing the need to participate in the global market and the importance of having a computer-literate society, has initiated many computer-technology programs aimed at addressing issues in this area. Some of these programs will be briefly described in the following section.

3.13 Computer technology programs in South Africa

3.13.1 Gauteng online

Gauteng online is a technology access program initiated in schools by the Gauteng province. The model involved setting up a computer laboratory with 25 work stations connected to a file server with the appropriate software. Some of the important goals were to:

- Create a vibrant local ICT industry, thereby providing positive economic activity in the country;
- Improve government service delivery and a better life for all; and
- To position the province at the cutting edge of change through technology innovation (Gauteng Online, 2010).

3.13.2 Shuttleworth foundation

Mark Shuttleworth established the Shuttleworth foundation in 2001, with the primary objective of promoting and supporting technology in education in South Africa.

One of the foundation's major achievements was to establish the Freedom Toaster project. This is a computer-based kiosk pre-loaded with free digital products. This project was initiated to overcome the barriers experienced in obtaining Open-Source software due to the poor telecommunication infrastructure in certain parts of South Africa, where the downloading of programs was impossible.

Shuttleworth's hope is that his success in technology will inspire others, and he is committed to providing learners with the opportunities that they need (Mark Shuttleworth Foundation, 2010).

3.13.3 SchoolNet South Africa

Schoolnet is an online learning model for educators. It covers areas in both technical and educational aspects. Furthermore, Schoolnet is used to guide the online network of educators who want to use computer technology more effectively.

This is achieved by using a series of CD-based distance learning modules. This network is seen to build strategic alliances between educators, learners and schools to share resources and to prepare learners for the information highway (SchoolNet South Africa, 2005).

3.13.4 Thutong portal

Thutong (meaning "place of learning" in SeTswana) is a portal which provides access to a wide range of curriculum support relevant to the needs of South African educators and learners. There are various subject learning areas.

These discuss issues such as classroom management and difficult sections of the syllabus. The portal serves as a starting point for educators seeking information to use in their projects and in their classrooms. Their success rests on the partnerships of the South African educational stakeholders and the various role players (Thutong South African National educational Portal, 2010).

3.13.5 e-Schools network

In 1993 a group of educators found that e-mail played a significant role in their profession and founded the e-Schools network. It was formally known as the Western Cape schools network. Originally, there were 10 schools that participated in this project. This number has since grown to 1700 schools countrywide.

This network is a non-profit, self-funded operation that provides services to South African schools and colleges. It provides support for project development and management, consultancy, training-support services in education, technology and connectivity solutions. The e-Schools network is fervent about low-cost technology solutions for schools and has been one of the few institutions that lobbied support for the government's ICT policy (E-Schools Network, 2010).

3.14 Summary of computer initiatives in schools

Personal observation has indicated that some of these projects were unsuccessful and the uptake of computers used for teaching purposes has been slow.

Concerns, such as educator preparation and the management of the implementation process, need to be carefully planned to ensure a successful integration of computers into the curriculum. The provision of computer facilities to schools without proper educator training and instruction does not bring about computer integration into educator pedagogies (Afshari *et al*., 2009; Ward and Parr, 2010).

The literature on the uptake of computer usage in education indicates that in many countries, educators have started using computers in very rudimentary ways. A possible reason for this is that both educator and learner go through a developmental phase to familiarise themselves with technology (Fullan, 2001).

A study by Govender (1999) pointed out that there is sufficient evidence to prove that South African educators do not understand the concept of educational technology although they have essential roles to play in the integration of technology. He strongly feels that educators in South Africa must be fully trained and provided with the necessary skills enabling them to include computers in their teaching. Govender is of the opinion that computer technology as a discipline is very much underdeveloped within the South African educational landscape and educators must be able to understand what technology integration is all about.

Quality in education is an obscure concept and the introduction of Outcomes- Based Education with its assessment criteria was an attempt to enhance accountability, innovation and quality. Miller and others (2006a) assert that motivated, well-trained and skilled educators will make a difference to the quality of education and the computer skills of learners. Moreover, educators who have personal aspirations of including computer technology in their lessons will be able to increase their productivity in the classroom.

3.15 Factors affecting the educators' use of computers

3.15.1 Educators' theories and beliefs

Educators' theories and beliefs are shaped by their teaching philosophies (Sugar, Crawley and Fine, 2004). For the use of computer technology to be successful in classrooms, educators must be keen to change their beliefs and roles (Strydom *et al.,* 2005; Baylor and Ritchie, 2002).

Educators must be confident and competent when using computers so that these skills may be transferred to their students as well. As there is a shortage of educators worldwide, the need to employ educators in all teaching fields, as well as to replace an increasingly ageing work-force, is critical (Haddad and Jurich, 2002).

In order for educators to be effective, they must remain abreast of any computer technologies used in education and in their areas of specialisation as well - a task which becomes increasingly impossible when educators have to deal with large classes and undertake onerous administrative duties (Haddad and Jurich, 2002).

The traditional method of preparing new educators by using the mentoring system places an additional burden on the experienced educator, especially in schools where they are in short supply (Haddad and Jurich, 2002).

Educators have come to believe that using videotaped lessons of experienced educators teaching in classrooms, for the preparation of pre-service educators, must be considered (Haddad and Jurich, 2002). Furthermore, they argue that videos can be used to scrutinise teaching styles and teachers' various idiosyncrasies. Such videos could assist educationists to make amendments to educational policies (Brown, 2009). As explained earlier, educators' beliefs are not easy to change and many educators do not enjoy changing them. Therefore, it may be suggested that computer technology should synchronise with the existing theories and beliefs of educators.

Zhao and Cziko (2001) state that using technology obliges educators to adopt different teaching styles. Consequently, educators may resist the use of computers in their classrooms.

Educators believe that with the huge influx of educational learning material that has now become available in the form of videos, multi-media and CD-ROMs, computers can create a motivational environment for the most inert, discouraged learner, and allow the disadvantaged access to learning (Kellner, 2000). With this in mind, educationists predict that the incorporation of computers into curricula will eventually pose huge challenges to education (Drenoyianni, 2006). Furthermore, Drenoyianni (2006) states that computers will act as a conduit in educators' pedagogical thoughts and beliefs and offer the incentive for a fundamental change to more progressive practices.

Research has indicated that educators with more 'student-centred-beliefs' often use computers more frequently and allow their learners to engage in more technology-supported practices (Becker, 2000). In addition, Becker (2000) states that educators with more 'traditional-beliefs' tend to use computers less often.

Richardson (2003), however, suggests that educators' personal experiences with schooling and instruction will have an impact on their theories and beliefs about computer technology. In their study, Zhao and Cziko (2001) concluded that educators must have the will and believe they have the ability to use computer technology.

Another study by Lim and Khine (2006) reported that educators believed that the mere use of computers in their lessons excited and motivated their students to learn. The educators in their study only used computers to break the "monotony of chalk and board" (Lim and Khine, 2006, p.118).

By only focusing on how to use computers, and by not dealing with the issue of how to teach students more efficiently, the use of computer technology integration into education has failed. This has caused educators to miss the forest for the trees (Guha, 2000; Bosely and Moon, 2003; Wild, 1996).

In a review of educational reform, Fullan (2001) suggested that since technology is ubiquitous, the issue is not whether, but how individuals are going to contend with it.

He states that as technology becomes more powerful, good educators become even more indispensable; and educators must become experts in pedagogical design (Fullan, 2001). However, educators want to experience positive outcomes in the classroom first - before they alter their beliefs (Mueller, Wood, Willoughby, Ross, Specht, 2008). Educators should be aware that educational information is available from additional sources besides textbooks and other media. It is the duty of the educators to inform their students of the different ways in which they may gain access to educational information.

In order to make their lessons exciting and informative, educators should be competent in using a wide range of technological tools, such as data projectors, scanners, podcasts and software as part of their lesson delivery in classrooms. However, these need to fit into the educators' theories and beliefs about the use of computers in the classrooms (Mueller *et al*., 2008).

Hadley and Sheingold (1993) state that technologies must be pedagogically sound. For computer technologies to be effective, Byrom and Bingham (2001) maintained that such technologies must go beyond mere information retrieval to problem solving. In addition, they state that allowing new teaching and learning experiences; promoting deep processing of ideas; increasing student interaction with subject matter; promoting educator and student enthusiasm for teaching and learning and freeing up time for quality classroom interaction, will all help to improve educator pedagogy.

Ward and Parr (2010) found that educators are sensitive to change and if they do not see a change without any clearly recognised benefits, such as increased efficiency in administrative tasks and improvement in the learners' understanding of the subject, they will be hesitant to use computers in their teaching.

Byrd and Koohang (1989) developed a simplified model of the professional development process (see Figure 3.4). These scholars strongly believed that practical experience must be combined into the structure of professional development activities that are linked to computers. Based on their model, the authors stated that it is important that educators learn what is relevant and how such issues could improve teaching and learning in their classrooms.

Therefore, the relationship between the educators' development and their beliefs in regard to the use of computers in the classroom will depend on quality development programs. Such a program will, in turn, support educators in changing their theories and beliefs towards computer technology (Byrd and Koohang, 1989). Furthermore, the model indicates that as educators use computers, they stimulate changes in the learning conditions of the students.

Byrd and Koohang (1989, p.402) point out that "if feelings of success come from these changes then significant change takes place in the teacher's beliefs and attitudes towards usage which leads to increased usage". The 'perception of future usage' means that those educators who perceive to use computers in the future will also have "increased perceptions as to the usefulness of computers" (Byrd and Koohang 1989, p. 403).

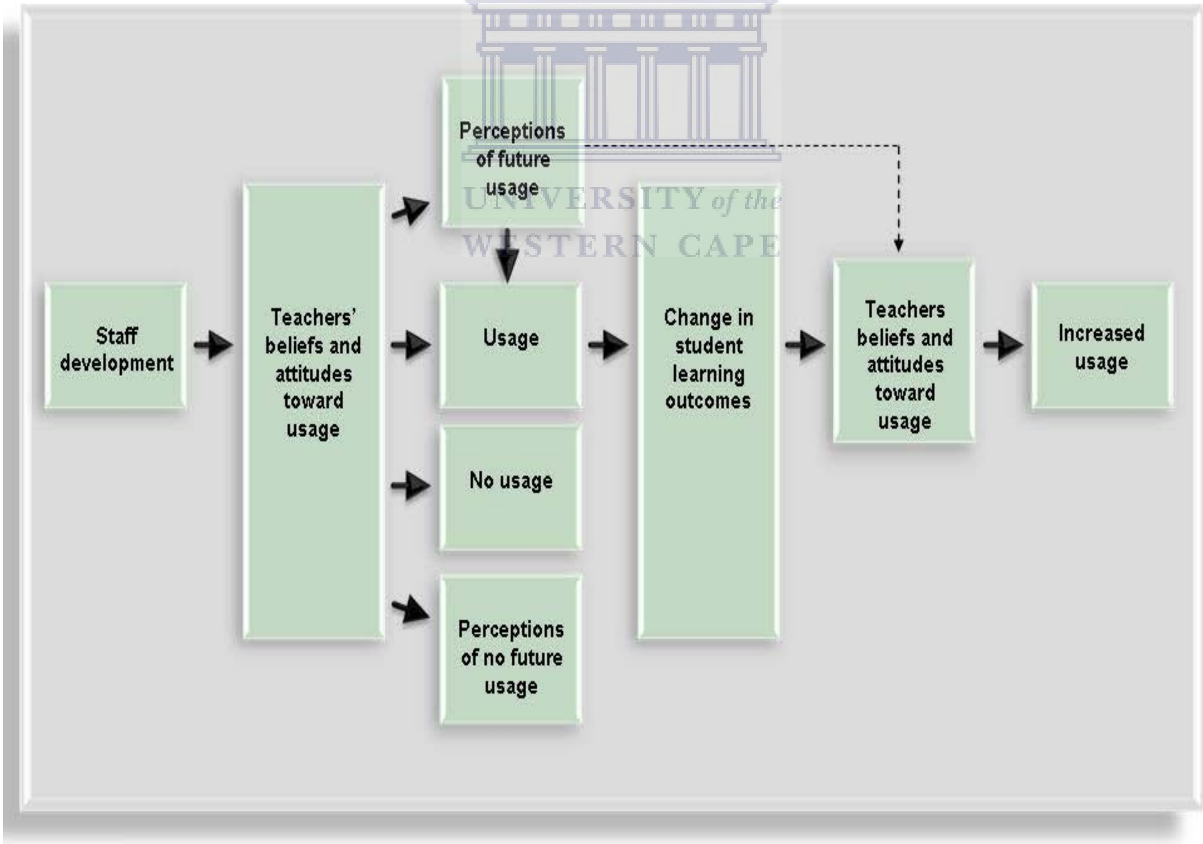

Figure 3.4: Model of the staff development process and the relationship of beliefs and attitudes to usage and perception of future use (Byrd and Koohang, 1989)

3.15.2 Educators' access to computers

When talking about access, it is imperative to consider not only the access educators have to the use of computers in the classrooms, but the access they need to prepare lessons, to find new knowledge and to plan their lessons in their own time. Therefore, in order to achieve this, educators should preferably have access to their own personal computers (Martin *et al*., 2004; Mueller *et al*., 2008).

Guha (2000) is of the view that educators' confidence in using computers will increase because of the amount of personal access educators have to ICT - whether this is at home or elsewhere.

Another study reported that educators who made little personal use of computers, had low levels of confidence in using computers in their lessons (Pamuk and Peker, 2009).

A survey conducted in South African schools concluded that 93% of educators had access to computers for teaching and learning purposes (Strydom *et al*., 2005).

Although the response rate of 231 out of 1078 educators sampled was lower than desirable (21%), information extrapolated from that study presented some important findings regarding access to computers. Strydom and others reported that 79.1% of schools had computer laboratories and in terms of access suggested that the majority of the participating schools were beyond the 'emerging' stage. Educators could now teach within the 'applying' or 'infusing' stage, as schools were able to offer learners opportunities to use computers. These stages were developed in the UNESCO (2002) model on educator development.

The UNESCO model defines the 'emerging' stage as the stage where schools are at the beginning stages of computer development, such as the purchasing of computer equipment. The 'applying' stage refers to educators who are using computers for tasks already being undertaken in the school. The 'infusion' stage involves integrating computers across the curriculum. Furthermore, their study revealed that 80.7% of participating schools had no computer access in their classrooms, but only in the computer room.

This lack of access (emerging phase) suggests that the integration of computer technology in curricula is still restricted, as educators do not have constant access to information. A striking result in the study of Strydom and others (2005) revealed that 58% of educators who used computers during their lesson delivery had access to between 11 and 20 computers. However, 33% of educators reported that they had never used computers during their lesson delivery, yet they had more than 21 computers in their schools.

This finding adds a new dimension to access. Having increased access to computers does not necessarily imply increased computer usage for lesson delivery. Referring to the UNESCO model, it seems there could be a gap between computer access being at the ‘applying’ or ‘infusing’ stage, while educators’ use of technology may be lagging behind at the ‘emerging’ stage.

Another study by Howie and others (2005) claims that less than 15% of schools in South Africa have access to computers for teaching, and therefore not much can be achieved in the field of computers in education.

Contrary to idealistic notions of change, students and educators in Silicon Valley schools maintain that when compared with the past, they now have greater access to computers (Drenoyianni, 2006). In Europe, for example, Drenoyianni (2006) believes that access to computers is steadily increasing, and may vary from country to country. Despite these manifold advantages of computer access in developed countries, it is important to note that access is not always an easy and straightforward issue.

For example, Drenoyianni (2006) discovered that only 5% of educators in the Silicon Valley schools used computers in their regular curricula and teaching routines. She argues that even though access is a key indicator determining computer use, resources at schools may not be perceived as a natural indicator of equal computer availability. Notwithstanding this, she states that “computer availability does not equate with computer use” (Drenoyianni, 2006, p.403). Moreover, she believes that educators and students may obtain different levels and types of access in various educational locations.

Although the availability, quality and access to computer hardware are regarded as important factors in the use of computers in education (Jones, 2004; Pelgrum and Plomp, 1993; Balanskat, Blamire and Kefala, 2006), having a computer available to an educator tells one nothing about whether it is switched on, or is well used. Therefore, numbers are not important indicators on how computers are actually being used.

Effective educators who are using computers in their lesson delivery not only know how to use and select the different software applications, but they are also selective in the software they choose and implement. These issues are important for their specific teaching requirements (Guha, 2000; Bosley and Moon, 2003).

It has been found that a lack of access can be a complicated inhibitor to the efficient use of computers and can be categorised into three types of access failure, namely: lack of and faulty computer hardware, incompatible or poor quality software, and poor organisation (Jones, 2004).

According to Clark (2000), access to technology and software is important in the effective use of computers in education. Furthermore, he observed that restrictions in technology access resulted in reduced levels of computer utilisation. This was supported by the findings of Mueller and others (2008), who assert that the lack of access to computers and software programs is a huge hindrance to the effective use of computers in schools.

Bates (2000) laments that schools may purchase many computers to support teaching and learning, but if these are not readily accessible, then the investment may be considered as wasted. Consequently, if computers are easily available and all resources and peripherals are in proper working order, educators should be motivated to use them.

3.15.2.1 Educators' access to computer resources

The National Education Policy Investigation (NEPI, 1992) report in South Africa highlighted the issue that the creation of education departments under the previous political dispensation resulted in gross discrepancies and unfairness in the provision of resources to schools.

Consequently, a backlog still exists in the education system regarding resources, technical support, good quality educational programs, funding and more specifically computer equipment, such as white boards, scanners and projectors.

According to Gordon (1997), South Africa represents two worlds in one, with a few schools that are extremely well resourced with sophisticated computer systems, highly motivated educators with bright learners; and, on the other hand, schools that do not have any computer resources at all (Isaacs, 2007; Wilson-Strydom, 2007).

Providing access to computers from various locations, and in the educators' own time, has a positive impact on the use of computers in the classrooms (Williams, Coles, Wilson, Richardson, Tuson, 2000). However, the study of Williams and others (2000) cautions that educators accessing computers from home, were already motivated to use computers in schools. In addition, the authors hasten to state that assumptions cannot be made that providing computers for home use will necessarily change an educator's attitude towards the use of computers in classrooms.

Access to resources is a complex barrier and may be sub-divided into various categories (see Figure 3.5), such as hardware, software, quality and organisation (Jones, 2004).

The directional arrows in Figure 3.5 indicate what the phase 'can lead to'. For example, 'lack of time' is linked to inappropriate software, illustrating the fact that educators do not have sufficient time to meticulously evaluate educational software. The curved arrows indicate other relationships, such as the lack of hardware at school. This is closely related to the lack of access to computers at home.

This association means that if educators had access to computers at home to prepare their lessons for the next day, then this could have alleviated the demand for such resources at school.

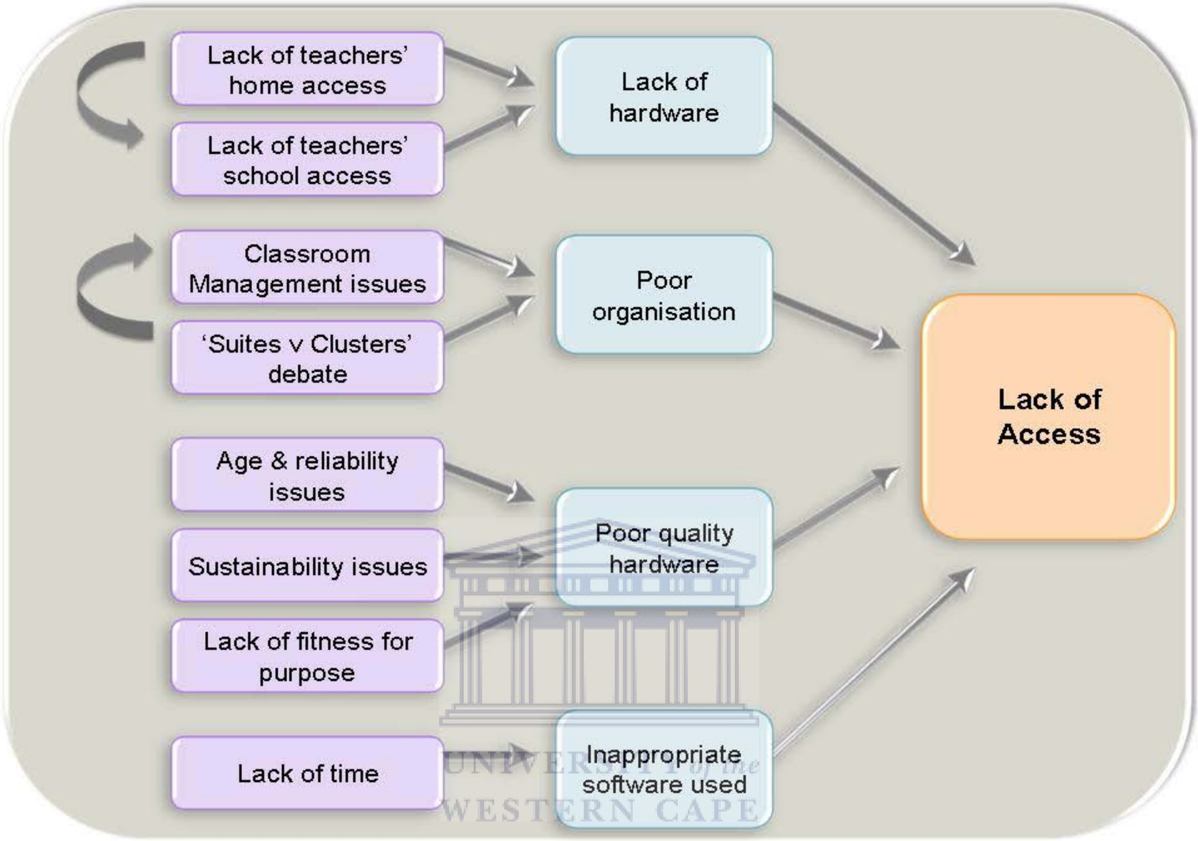

Figure 3.5: Issues relating to the access to resources barrier (Jones, 2004, p.22)

The successful use of computers in classrooms depends on whether the schools have the necessary supply of computers and related computer accessories.

Research findings have indicated that a lack of computer equipment inhibits the use of computers in the classroom (Eteokleous, 2008). Furthermore, educators expressed their views on being informed about the availability of educational software, and how this software would contribute to lesson delivery in the classrooms (Eteokleous, 2008). It could be argued that the effective use of computers in education depends on how educators are briefed about the different software programs and what value these could bring to their teaching (Farrell and Isaacs, 2007).

Therefore, the lack of sufficient computer resources not only inhibits educators from making use of computers in their classrooms, but also has a detrimental effect on the learners' progress (Balanskat *et al*., 2006).

Jones (2004) is of the view that educator access to computer resources is a complex issue and is not just the simple matter of a lack of hardware and software in schools. For example, in the Becta (2004) study of educators, as many as 20.8% of the responses revealed a lack of adequate resources. Some of the respondents mentioned that they had to work with poor quality computer resources.

In addition, the Becta study of (2004) revealed that although some educators had sufficient good quality computer resources, educators were still having difficulties because of poor organisation of these resources.

3.15.2.2 Computer hardware issues

Educators will not be able to use computers during their lessons without having computers that are in proper working order. Regarding the uptake of computers into education evidence suggested that a lack of computer resources causes barriers to teaching and learning, thereby creating frustration among educators and resistance to the use computers (Eteokleous, 2008; Jones, 2004).

A study by Pelgrum (2001) found that educators complained mostly about the lack of computers in classrooms as being their biggest obstacle to the integration of computers into education. Guha (2000) also found similar results. In addition, he reported that it was those educators who were using computers the most who were complaining about insufficient equipment. Pelgrum (2001) observed that there could be a mismanagement of resources, as they found that there were some educators who still complained about a lack of computers, even when an adequate supply existed.

Strydom and others (2005), support Pelgrum by postulating that more computers do not necessarily mean more access. They argue that location, the correct number of computers and the appropriate software programs are of paramount importance for educators to use computers effectively (Strydom *et al*., 2005).

Closely related to location, access and the number of computers available for educator use, is the quality of these resources.

Evidence found in the British Educational Suppliers Association (BESA, 2002) report, revealed that a third of all its desktop computers were faulty and could not be used for teaching purposes. Thus, there is sufficient evidence to support educators who become demotivated about using computers, since many of these are old, faulty, and unreliable (Preston, Cox, M, and Cox, K., 2000; Martin, Mandinach, Kanaya and Culp, 2004). In addition, this issue was exacerbated by the fact that students had the latest technology and faster computer equipment at home, and this created even more difficulties for educators who were struggling with outdated equipment in classrooms (Preston *et al*., 2000). A study by Becta (2003) found that when educators were supplied with laptops, there was an extensive impact on their planning and preparation of materials used in lessons. Educators commented that they could now produce higher quality work, and could manage their time more productively. In particular, educators reported that they had now become more confident and competent in using their laptops, and were excited about exploring and experimenting with computers during their lessons (Becta, 2003).

3.15.2.3 Computer software issues

According to the Afshari and others (2009), a number of educators felt that the computer software they were using was not appropriate, and did not enhance their lessons in any way. Guha's (2000) work emphasises the fact that poorly designed software, and factors preventing educators from designing their own software, were recipes for educators to 'throw in the towel' and choose not to use computers in their classrooms.

Bosley and Moon (2003) concur that inappropriate software can exclude students from the learning process, resulting in further barriers being created to the use of computers in education. Furthermore, the authors highlighted the fact that the perceived high costs of software licences and insufficient time for educators to evaluate such software are factors that can also inhibit the use of computers. Knowledge of the various types of educational software is necessary.

Educators should not become inundated in attempting to master all the details of the software. Instead, educators should concentrate on the important features of the various types of software. Empirical evidence from the above studies clearly indicates that the provision of proper computer hardware and software would motivate and encourage educators to use computers in classrooms (Jones, 2004; Bosely and Moon, 2003; Preston *et al*., 2000).

Access to software appeared to be a source of frustration for educators (Becta, 2002). Furthermore, the Becta study found that these frustrations occurred in areas where decisions were taken centrally without any support for or contributions from educators. This reinforces the notion that support from principals and district educational managers could make a significant difference. The most common response regarding obstacles to computer software in South African schools (see Table 3.1) was the insufficient number of copies for teaching purposes.

Moreover, principals emphasised that "the lack of information about the software" was also one of the obstacles to using computers in schools (Howie *et al*., 2005, p.52).

Table 3.1 Software obstacles to achieving the school's ICT-related objectives (Adapted from Howie *et al*., 2005, p.52)

	School Principal	Technology Co-ordinator
Not enough copies of software available	59%	52%
Not enough variety of software	52%	9%
Software not adaptable enough		25%
Lack of information about software		31%
Software not in language of instruction		21%
Software not culturally compatible		8%
Software not compatible with curriculum		22%

It is important that governments and educational departments include sufficient funding in their recurrent budgets to provide schools with funds to upgrade educator skills, and to allow educators to experiment with the latest educational computer software available.

The literature revealed (Afshari *et al*., 2009; Guha, 2000) that quality educational software is vital for maximising the use of computers in schools.

3.15.3 Educators' attitudes towards computers

Educators' attitudes, theories and beliefs regarding computers have been scrutinised for over 20 years as computer technology has established itself as an integral strand in education (Cox *et al*., 1999). Therefore, the use of computers in teaching and learning potentially changes traditional teaching practices which have been developed over time.

Rogers (2003) states that before a decision to adopt an innovation can be considered, a favourable or unfavourable attitude towards the innovation has already been formed. It has been argued that educators exert the biggest influence in the implementation of computer technology into teaching, and so their attitudes and beliefs are crucial factors which necessitate due consideration.

In envisioning viable alternatives, due regard must be given to Bialobrzeska and Cohen's (2002) 'Guide for School Principals' which suggests that principals are critical agents of change based on their position in schools. Thus, their attitude towards computers has an important role in the successful implementation of computers in education. There have been a few studies which investigated the relationships of attitude and the use of computers.

These were mainly based on Fishbein's and Ajzen's (1975) theory of reasoned action. Attitude, as defined by Ajzen and Fishbein (1980, p.28), is "an index of the degree to which a person likes or dislikes something about the object". Therefore, it has been hypothesised that computer attitudes affect the user's behaviour which, in turn, will affect the actual use of computers (Ajzen and Fishbein, 1980).

Consequently, attitudes towards computers are expected to have an impact on a person's self-efficacy. According to Bandura (1977), self-efficacy is the belief that one has the ability to perform a task. This implies that using computers does not mean there is necessarily a general interest in computers - unless the educator has a positive attitude towards the use of computers.

Closely related to the above discussion is the review of the literature on attitude and behaviour. This is complex and should be approached prudently. Research conducted by Duggleby and others (2004) has confirmed that changing the attitudes and behaviours of educators was crucial to the success of their online teaching course. They argue that competences of educators are substantially different from the normal face-to-face teaching.

A case study by Kay, Caffarella and Tharp (1999) investigated the use of computers in pre-service education. The authors observed that the attitudes of educators needed to change so that educator roles and responsibilities could improve from being merely a 'dispenser of knowledge' to a 'facilitator of knowledge', to a manager of information resources. This changing of roles points to an important question on the use of computers in teaching, namely the educators' attitudes and beliefs about technology.

According to Dexter, Anderson and Becker (1998), as educators' beliefs and attitudes about technology change for the better, they will behave more as facilitators by assisting students to access and process information.

When Outcomes-Based Education (OBE) was implemented in South Africa, many educators adopted a negative attitude towards this innovation (Jansen and Christie, 1999). These authors are of the view that such educators did not understand the reasons for the change and why their teaching styles had to alter; hence, they resisted the change. Subsequently, research done by Young (2000) and Balanskat and others (2006) argues that the success of curriculum innovations depends on the attitudes of the educators.

Jawahar (2002) and Chau (2001) point out that people who hold favourable attitudes towards using computers are more likely to learn these skills, thereby achieving higher levels of performance on tasks that require the use of computers. Furthermore, attitude, according to Jhurree (2005) and Afshari and others (2009), has been defined to include a variety of relationships: from a liking to a dislike of computers, to complex attitudes and being threatened by the use of computers.

Clark (2000) is of the view that educators who have had previous computer integration experience will have more positive computer attitudes. As alluded to earlier, the use of computers seems to be affected by training and this is likely to exert an influence on their use (Sánchez and Salinas, 2008). In the review of the literature on computer attitudes, it was reported that those educators who had some form of computer training, showed positive attitudes towards the use of computers in the classrooms (Jones, 2004).

Another study conducted in UK secondary schools found that although educators acknowledged the advantages of using computers during their lesson delivery, they had some reservations about actually using them (Bliss, Chandra and Cox, 1986). The authors believed that the educators were concerned with the quality of educational software, the idea that the learners might use the computers solely to play games, and that only those learners confident in using computers would do so, leaving the less-confident learners to lose out. These reservations imply that attitudes and beliefs have a great influence on educators' decisions to use computers in their lessons.

According to MacLeod, Haywood, (D) Haywood, (J) and Anderson (2002), the overall attitude towards computers in education has become more positive. In addition, they state that the reported attitudes of women and men are now converging to a point where no significant differences are visible.

Kitchen, Finch and Sinclair (2007) in their study also found that educators had positive attitudes towards the use of computers. These scholars state that educators found the material on the internet to be useful for their lesson planning and preparation. In addition, educators were satisfied about the use of the subject-specific software and internet-based resources used in most of their lessons.

3.15.4 Educators support in using computers

As the use of computers becomes more pervasive in curricula, educators become increasingly dependent on them for teaching and learning activities in their classrooms. Therefore, educator dependence on computers requires support systems that have to be increasingly more reliable, whether they are technical or collegial (Smarkola, 2008; Martin *et al*., 2004; Ward and Parr, 2010).

Computers have been in many classrooms for a number of years now. However, there are several barriers that have consistently stifled the broader use of computers in education.

While there are some educators who are risk-takers and are willing to chance new methods of teaching, most educators are afraid to do so because they cannot immediately see the benefits (Newhouse, Trinidad and Clarkson, 2002).

3.15.4.1 Support from school principals

In exploring the literature about the use of computers in classrooms and searching for strategies to improve teaching and learning outcomes, the role of the principal became increasingly apparent.

Schiller (2003) indicated that the use of computers is having a huge impact on the way in which principals manage their schools and what changes they effect in their leadership styles.

Fullan (2001) is of the view that the school principal is the key to bringing about successful change in a school. Being the leader of the school, a principal must be aware of new technologies and ensure that educators in the school have a personal proficiency in their use.

By doing this, principals create a culture which supports the exploration of innovation and change in teaching and learning (Sánchez and Salinas, 2008). School principals carry major responsibilities for initiating, implementing and supporting changes in teaching by using computers for lesson delivery.

Moreover, Schiller (2003) postulates that most principals are not equipped to assume the role as technology leaders in their schools because of a lack of any meaningful interaction with computers and learners. In the literature of computers in education, it was found that school principals play important roles in determining the effectiveness, efficiency and the way in which computers are used in classrooms (Afshari *et al*., 2009). Consequently, principals are expected to develop programs to support educators in their use of computers in classrooms.

Another study by Yee (2000) revealed that principals represented a firm commitment by providing adequate computer hardware, software and professional development support to their educators. Furthermore, Yee (2000) highlighted the fact that the principals in his study were 'entrepreneurs' who skilfully constructed strategic alliances among social networks to locate creative sources of computer hardware, software and computer expertise for their staff. This type of commitment and support motivates educators to use computers in their classrooms. The literature supports this conjecture.

Exploratory investigation into the implementation of computers in classrooms has revealed that principals perceive them "to be too complex and fraught with difficulties" (Schiller, 2003, p.172). Therefore, in order to gain complete support from principals in the innovation process in schools, principals must be proficient in their own use of computer technology (Smarkola, 2008).

3.15.4.2 Online support

Jackson (2000) postulates that due to the advent of the internet, educators can now obtain educational material and animations to enliven their lessons. He states that chat rooms, video conferencing and educational forums, through the internet, have become a laboratory for new ideas.

According to Madingoane (1999), educators in Soweto, South Africa, used online connections with schools in Birmingham in the United Kingdom to create support networks.

3.15.4.3 Collegial support

Another study by Hadley and Sheingold (1993) investigated the use of computers in teaching and learning. This study revealed that educators received support from numerous people - including educators from other schools, external consultants and the district school co-ordinator. Furthermore, educators worked in a supportive environment with other educators so that ideas could be shared on the use of computers in teaching.

Using segmentation analysis, one of Hadley and Sheingold's (1993) five classification segments was 'unsupported achievers'. This group of educators complained about the lack of support from colleagues, problems in accessing computers, poor software and a lack of computer training as barriers to the use of computers in education (Hadley and Sheingold, 1993).

3.15.4.4 Administration support

Clark (2000) is of the opinion that educators require considerable support from the school's administration body and from the technology and training personnel to positively use computers in their classrooms.

There are a few examples where some schools have strong ICT policies in place. Consequently, the use of computers in these schools is exceptionally high (Reynolds, Treharne and Tripp 2003).

3.15.4.5 Technical support

Reynolds and others (2003), confirm that these educators have the full support of a computer specialist. Hence, educators in these schools are now gaining confidence in the use of computers for teaching, as they feel they have proper support.

Technical support and general computer maintenance of educational equipment is considered to be one of the major setbacks in the use of computers in education. Many schools, including those in South Africa, are still facing the challenges of providing an efficient and cost-effective technical support service for their educators (Kitchen *et al*., 2007; Becker, 2000).

The support of the technical assistant is important for educators. Moreover, educators depend on the support of their technicians, especially when lessons are conducted in laboratories (Jones, 2004).

According to Rogers (2003), compared with earlier adopters, later adopters prefer support and service within close proximity to them. Therefore, whoever takes on the responsibility of technical support in schools must ensure that educators and students receive reliable and accessible service provision.

Butler and Sellbom (2002) provide the following recommendations for technology support personnel:

- Schools must convince the technology support personnel that reliability is extremely important, particularly technology support in classrooms;
- Improve systems for checking and maintaining classroom technologies;
- Ensuring that rapid responses are made in the event of breakdowns;
- Encourage educators to assess and evaluate the impact of technologies on learning;
- Identify attitudes and behaviours that are seen as poor or inadequate support and working with technology staff to reduce this; and
- Classrooms should be set up so that they are as similar as possible.

Computer malfunctions during lessons do create disruptions, and if there is limited or no technical support, then it is likely that maintenance on computer equipment will not be performed (Jones, 2004).

Consequently, computers will be inoperative for extended periods, resulting in fewer opportunities for educators to use such computers. By interviewing educators, Cuban, Kirkpatrick and Peck (2001) identified that if there are regular computer malfunctions, then the confidence in the technology's appeal diminishes, and this decreases the educator's rate of computer use.

Educators then feel that there is nobody they can call on for support. Lundall and Howell (2000) suggest that information systems should have constant maintenance and periodic upgrades.

They state that technical personnel who are responsible for the upkeep of the computer systems need to be highly experienced and skilled, and should be able to assist educators who are experiencing difficulty with their computers. Therefore, if there is a lack of technical support in schools, it means that preventive maintenance cannot be performed, resulting in higher risks of computer malfunction. The problem of a lack of technical support and maintenance has been reported in developed countries as well.

Preston and others (2000) report that the breakdown of computers inhibits the use of computers in schools. Moreover, the authors comment that technical computer problems result in the demotivation of learners. In support, Jones (2004) advocates that if technical support is constantly provided, then educators would continue to experiment with the use of computers in the classrooms, thereby benefiting the educator, the students and the whole school.

A few studies found that there were technical support assistants who provided support in organising access to computers, trouble-shooting of computer hardware, software, and providing advice on software packages (Jones, 2004; Becta, 2004; Cox, Abbott, Web, Blakeley, Beauchamp and Rhodes 2004). Moreover, there were only a few schools that had support technicians permanently based in the computer rooms, offering assistance to educators and students alike.

There seems to be a correlation here: The more computer malfunctions occur, the more likely educators will be to avoid the use of computers during their lessons.

Snoeyink and Ertmer (2001) found that educators who were unsuccessful in using computers owing to technical 'glitches' would then avoid using computers for many days.

The above discussion thus illustrates the importance of sufficient technical support being available in schools.

3.15.4.6 External support

External support in the form of training may also be provided; however as alluded to earlier, it must be carefully monitored to ensure that it meets the needs of educators (Grove, Strudler and Odell 2004). In addition, educators receiving support using electronic networks and forums would benefit by developing more confidence, motivation, and improved access to resources (Scrimshaw, 2004).

Preston and others (2000) argue that due to the complex nature of computers in education, educators will require ongoing or follow-up support on the training courses they have attended. She adds that providing high quality resources can become a difficult task. However, she presents a range of supporting activities which can be beneficial to educators:

- Information on hardware and software which is readily available;
- Opportunities to discuss issues with others;
- Lesson plans and schemes of work;
- Follow-up activities; and
- The availability of local technical support.

Providing the appropriate support for the teaching profession to gain its own autonomy will become an increasingly important part in the systemic process of change. Educators and schools require support relative to their varying stages of development.

Accordingly there seems to be three aspects of support that will facilitate the effective use of computers in the classroom (Twining, Broadie, Cook, Ford, Morris, Twiner and Underwood, 2006). Firstly, educators rely on a robust technical support infrastructure. Secondly, there must be a 'just-in-time' support where the problem is situated and thirdly educators must engage in ongoing professional development in order to make consistent and effective use of computers (Twining *et al*., 2006).

Therefore, dedicated computer resources and time allocation in support of educator professional development should be made available, juxtaposing reliable hardware and the latest software.

It seems that support remains an ambiguous issue in education. The value of support is only appreciated when it is required, and the lack thereof always evokes a complaint. In the review of computer literature, not all school principals were supportive of computers in education, but as the inexorable inclination towards the use of computers in the classroom progresses, educators must become technology-competent. The time has come where computer skills is a mandatory requirement for employment (Evans, 2003).

3.15.5 Educator training and computers

The introduction of computers into education is more complicated than the introduction of educational technologies (Pelgrum and Law, 2003). These scholars argue that this issue is a complex innovation procedure and presents challenging obstacles for educators during their routine work at schools.

Therefore, preparing educators to use computers in their teaching is a huge challenge for staff development. Furthermore, it is the principals' view that new educational tools or computer technology can only be strengthened by the participation of the whole school (Fullan 1991; Baylor and Ritchie, 2002).

The motivation of less-confident educators through training and support will lead to higher perceived ease of use and to the support of greater school involvement (Waite, 2004). Educator competence and educator confidence are two factors which are directly related to each other, and in order to achieve higher levels of educator competence in the use of computers, training must be provided (Jones, 2004).

According to Kirkwood, Van der Kuyl, Parton and Grant (2000), there is an abundance of literature suggesting that effective training is quintessential if educators are to implement computer use in their lesson delivery.

Improper and inadequate training may seriously hamper the educators' preparation to use computers in their classrooms, thereby lowering the educators' confidence (Jones, 2004). Consequently, the lack of educator competence combined with the lack of quality training, can be regarded as an inhibiting factor in educators' use of computers in teaching (Jones, 2004).

Moreover, Kirkwood and others (2000) observed that the New Opportunities Fund training was slow because some educators were 'technophobic' and did not participate in the training programs which were offered to address a widespread set of educator competencies. In some instances, educators became frustrated when trying to make use of their newly acquired skills - only to realise that they did not have access to the necessary technology after the training had been completed (Jones, 2004).

Another study by Smarkola (2008) found that educators who felt they had insufficient confidence in using computers, considered this to be a major inhibitor to the use of computers in their teaching. In addition, Smarkola concluded that educator computer competencies and skills should be addressed by means of the relevant training. A further problem with the conception process for educators wishing to use computers in their classrooms is that many of them have insufficient content knowledge, since they lack computer training (Preston *et al*., 2000).

The study by Howie and others (2005) reported that most principals held similar views, stating that educators' lack of computer knowledge was a major inhibitor in implementing their ICT policies in schools. Furthermore, these scholars suggested that there is a need for additional educator development regarding the use of computers in curricula. Educators, who are progressing towards using computers more frequently in their teaching, would also benefit from augmented productivity, less isolation and increased professional work satisfaction (Carlson and Gadio, 2002).

Educators could have been misguided in believing that by using computers, every lesson they present in the classroom would immediately become a shimmering, animated masterpiece of an electronic presentation (Pierson, 2004).

Consequently, this proposition places a negative attribute of computer technology in the minds of the educator as a regular component in their teaching practices (Pierson, 2004).

For many years, there has been a thrust in the school sector to search for ways in which educators can be convinced that computers should be part of their teaching strategy.

Various strategies have been attempted, such as investments in computer laboratories and equipment, curriculum portals on the internet and providing structures for broader international exposure to assist in curriculum development (Duggleby *et al.,* 2004; Cawthera, 2000). Among these strategies are training and the development of skills programs which seek to foster positive attitudes to computers on the part of educators.

Therefore, in order for any educational project to be successfully implemented, many researchers have argued that educators must be adequately trained (Fullan, 2001; Galanouli, Murphy and Gardner, 2004; Duggleby *et al.,* 2004). Thus, if well-trained educators are seen to be the foundation of the successful and innovative use of computers, then an appropriate strategy would be to concentrate on training in the relevant computing skills for pre-service and in-service educators. As a result, the significance of training in the educational use of computers can hardly be underestimated and it has long been acknowledged by concerned educationists that a robust computer-training program is imperative for educators (Becta, 2002).

A few scholars (Fullan, 1991; Zhao, 2007; Balanskat *et al.,* 2006) are of the view that the professional development and support of educators are critical issues for the implementation of innovations in education. According to Pelgrum and Plomp (1993), as well as Brown (2009), evidence on educational transformation suggests that the use of computers is most consistently linked to the skills and knowledge of educators; hence, training is a fundamental factor.

Research conducted in developed countries like the UK has revealed that not all educators are willing to introduce computers into their teaching (Galanouli *et al.,* 2004). Furthermore, many educators are not qualified to integrate computers into their teaching (Clark, 2000; Crawford, 2000).

Research has indicated that for the younger cohort of educators, the unwillingness to use computers in their teaching could be found in the quality of training provided in the use of computers in teaching (Strudler, McKinney, Jones and Quinn, 1999; Sang *et al*., 2010).

It has been found that one of the reasons why educators are reluctant to use computers is that they are not easy to use in a normal classroom (Sheingold and Hadley, 1990; Pamuk and Pekar, 2009). Moreover, Sheingold and Hadley (1990) state that even though a few educators have taken the initiative in improving their computer skills, it could take them up to five years to master computer-based teaching.

An initiative to support educator training in the UK, the New Opportunities Fund (NOF) training program of some 230 million British pounds, was designed to raise the students' level of computer-based skills by developing the computer expertise and skills of their educators (Selwyn, 2000). Furthermore, it was required that educators be knowledgeable about what computer resources are available for their subjects, and how they should be implemented during their instruction.

Problems encountered during the NOF training were that many schools committed themselves to an external training provider, unaware of the type of training they would receive. There were continuous problems during the training because most educators were at different levels of computer skills and competencies.

The following items of the final report reflect the effectiveness of the NOF training (Galanouli *et al*., 2004):

- Training is successful where the use of computers is recognised as a school priority;
- Where educators are themselves computer literate;
- Where there is sufficient support from senior staff members; and
- When educators have the confidence to adapt to the NOF's training materials.

Where the NOF training was unsuccessful, educators failed to complete the training and cited reasons such as:

- Lack of time;
- Technical and organisational problems;
- Poor training materials; and
- Trainers not being able to establish good working relationships with educators.

The report concluded that the NOF training “remained unsatisfactory in its overall effect” (OFSTED, 2002, p.3). As depicted in the above example, insufficient and inadequate training for educators in the use of computers is a huge factor affecting the integration of computers into teaching. Pamuk and Peker, (2009) suggested that in order to have a successful integration of computers into classrooms, educators must be properly trained.

Other studies by Smarkola (2008) and Zhao (2007) reported that a lack of training was the most common problem cited by educators as being the second highest barrier when it came to the integration of computers into teaching. Most of the young educators requested that they be given more computer training and support during their first year of teaching.

Another study by Carnoy (2004) found that although schools in California had high computer-to-pupil ratios, schools invested little in training educators to integrate computers into their regular classroom activities. Carnoy argues that it would be wrong to place computers in classrooms to enhance the learning process without training educators to teach differently when using computers. He adds that changing the way educators teach in using computers requires a big investment in the development of educator computer skills. Furthermore, Carnoy (2004) states that in many countries educators are lacking adequate content knowledge to teach even the simple basic academic skills to learners. Accordingly, Carnoy (2004, p.14), postulates that the training required to make educators “computer-savvy” is expensive. However, Carnoy believes that the new cohort of educators who have been growing up as children and have been using computers throughout their scholastic careers will substantially lower these training costs.

Jones (2004) highlights the fact that there are many educators ‘of advanced age’ who did not receive any computer training while they were in college. He argues that these educators are in need of computer training in order to use computers more effectively in their teaching.

The issue of educator training is complex, because there are various factors, which need to be considered in order to achieve a good impact (Jones, 2004). Jones argues that factors such as the lack of time for training, the lack of skills for training and the lack of pedagogical training itself must also be considered. A few authors concur with Jones (2004), that the use of computers requires time and development, and sufficient computer training must be provided early in the educational process (Lundall and Howell, 2000; Fullan, 2001; Zhao, 2007).

In their study, *Information and Communication Technologies in South African Secondary Schools*, Howie and others (2005) concur that there is a lack of training regarding computer-supported learning, although most schools have a policy whereby all educators receive some training. They noted that in many schools this policy had not been adequately implemented (Howie *et a*l., 2005). Another study in South Africa, conducted by Lundall and Howell (2000), concurs with the finding that the lack of trained educators remains a barrier to the start-up and effective use of computers in the classroom.

3.15.5.1 Pre-service educator training

With the infusion of technology into the professional lives of educators, teaching programs for new educators are challenged to provide new learning material where pre-service educators can ‘learn how to learn’ and how to teach, by using computers in their classrooms. Dawson (2006, p.288) states that “Teacher inquiry should be explored as a strategy to help prospective teachers in the process of learning to become effective technology-using teachers”. Therefore, it is imperative that educators should address the issues emanating from these sophisticated pedagogic challenges.

During the research of the educational literature, it was found that there were many computer courses offered to pre-service educators. However, Vannatta and Beyerbach (2000) state that some educators within the profession have the opinion that this training is insufficient and of poor quality. The authors argue that a computer course that teaches basic computer skills will not sufficiently prepare pre-service educators to use computers during their lesson delivery.

Another inhibiting factor to pre-service educators' use of computers in the classroom is the need for computer pedagogical training in educator training colleges (Sang *et al*., 2010). They argue that pre-service educators possessed sufficient computer skills; however, they were unable to transfer these skills to the use of computers in their classrooms. In addition, this problem was further exacerbated by a lack of motivation amongst pre-service educators to use computers during their teaching practices.

Barton and Haydn (2006) have sounded a strong note of caution about the pre-service educators' reluctance to use computers. These scholars state that given the exposure to all the training, pressures on trainees to use computers and the colossal amount of online educational resources available, they find it irresponsible for pre-service educators to resist the use of computers.

Furthermore, Howie and others (2005) suggest that educators should perform pivotal roles in ensuring that learners can engage in an information-overloaded society. In order to achieve this, pre-service educator training should be an urgent priority.

Many pre-service educators are of the view that computer technology ought to go beyond the computer courses taught in educator training colleges (Molebash, 2004). However, there seems to be uncertainty whether a few teaching-method courses will make any significant difference to the axiom: "Teachers teach the way they were taught" (Molebash, 2004).

Irrespective of this 'unknown' element, Wetzel (1993) and Koc (2005) state that faculty members in pre-service colleges play a crucial role in the educators' use of computers in schools.

Thus, a few critical conditions must be met in order for an efficacious computer technology infusion in pre-service educator courses to occur (Jacobsen and Lock, 2004, p. 82). Some of these are:

- Education faculty members need to infuse and model the effective use of computers across the curriculum;
- There must be adequate provision of learning opportunities for pre-service educators to integrate technology in campus and field experiences;
- To provide ubiquitous access to a more-than-adequate technology infrastructure; and
- To disseminate research on the effective use of technology for learning.

Koc (2005) argues that there are many pre-service educators who have graduated from educator training colleges with myopic views on how computer technology can be used in their teaching practices. The transfer of computer skills from educator training colleges to actual classroom practices has been termed 'the weakest link' of many educational innovations (Brown and Richie, 1991). Moreover, Koc (2005) believes that pre-service educators make limited use of computers in their classrooms. Therefore, as the need for computer-literate citizens increases, so too does the responsibility of the educational systems and governments to equip future educators to meet these demands.

Bai and Ertmer (2008) suggest that pre-service educators need to witness and experience technology use as students themselves before they can actually teach in classrooms. Furthermore, they state that fostering positive theories and beliefs towards computer technology amongst pre-service educators should be a joint responsibility for all the members of an educational system (Bai and Ertmer, 2008).

3.15.5.2 In-service educator training

As steady progress is being made in computer technology, educators are expected to be prepared to use this technology in their classrooms. According to Miller and others (2006b), educators should remain updated on new educational and specialised knowledge and should be well articulated in computer skills.

However, research has indicated that educator in-service course programs are not helping educators (Smarkola, 2008; Preston *et al.*, 2000).

Furthermore, Barton and Haydn (2006) believe that developments to include computers in education have not been so easily implemented as envisaged. Moreover, the authors believe that there is a danger of simply throwing information at the problem of using computers in education. Barton and Haydn (2006) declare that educators have been simply overwhelmed by the plethora of information; and, in some instances, they just "switch off'" - thereby divorcing themselves from computer technology altogether.

In Chapter Two the work of Davis (1989) was discussed, indicating that the perceived use and ease of use are two determinants with regard to the extent to which computer technology will be adopted by educators. In the literature, educators have realised that the use of computers is useful in lesson delivery (Jones, 2004; Strydom *et al*., 2005; Sang *et al*., 2010). However, some of the educators, in particular, the older generation, found that computers were not so easy to use (Jones, 2004).

This is a crucial issue, as the Guidelines for ICT Integration in South African schools (WCED, 2006) suggest that there are mechanisms in place on how educators should use computers in their classrooms. Karelse and Sayed (1999) state that educator training must consider pre-service and in-service training. In their study of *ICT in schools*, they reported that educators are still practising teaching styles from their original formal training with little confidence in how to use computers efficiently.

Furthermore, in-service educators require assistance in their quest to stay abreast of the latest computer educational and instructional technologies (Dawson, Swain, Johnson and Ring, 2004).

3.15.6 Educator pedagogy

The use of computers is complex especially on the pedagogical roles of educators, and a rationale for using computers in schools is their catalytic effect in transforming the teaching and learning process (Hawkridge, 1990).

Therefore, educators' pedagogical beliefs and theories play a critical part in moulding computer-learning opportunities in classrooms. Carnoy (2004, p.14) argues that most educators are arriving at the old conclusion that it is becoming increasingly difficult for them to improve teaching and "learning in schools by whatever means without improving teachers' knowledge of subject matter including ICT skills)". He states that educators are unable to develop higher-order thinking skills in learners, when they themselves have not acquired these skills. Moreover, he suggests that the use of computers for lesson delivery will always depend on the type of training the educator has received congruent to their skills.

It is therefore imperative that during the designing of new technologies, the expertise of educators must be included. A disconcerting observation by Williamson (2003) is that most educational design practices, from usability through to co-operative inquiry, are conducted in the absence of educators. Moreover, he laments the fact that this behaviour is improper, as it is the educators who have to incorporate computer technology into their teaching plans. By precluding educators from the designing of educational technology, there is a chance of developing computer innovations that will fall outside any pedagogical requirements. The mere introduction of technology alone will not be able to change the teaching and learning process.

The use of computers, however, will enable educators to change their teaching styles. Computers are used in education to support existing pedagogical practices (e.g. educator-centric, rote learning), as well as learner-centric (e.g. constructivist) learning models (Infodev, 2005). The use of computers, however, has become more effective when it assists in learner-centric pedagogies. However, Niess (2005) states that in order for technology to become an essential component for teaching and learning, educators must develop an overarching concept of their teaching material, and what it entails to teach, when using computers.

The survey by Strydom and others (2005) considered factors that influence the way in which educators impart knowledge and how students learn. Their study found that after educators were trained on the Intel® Teach to the Future program, 80% of their computer activity was related to administrative work (see Figure 3.6). Hence, this finding indicates that educators are merely "using computers primarily as a representational tool" (Strydom *et al.*, 2005, p.82).

An important aspect of educator training is not only to train them in how to use computers effectively, but to ensure that educators are knowledgeable when using computers to prepare their lessons (Jones, 2004).

As may be observed in Figure 3.6, educators' increased use of the Internet, CD-Roms and a reduction in the use of textbooks is an indication that computers can be used as a cognitive tool in education. It is worth noting that the low use of textbooks (38%) as the main guide for lesson delivery is of particular importance, since many educators depend on textbooks, which could be expensive, scarce or even outdated and possibly unobtainable too.

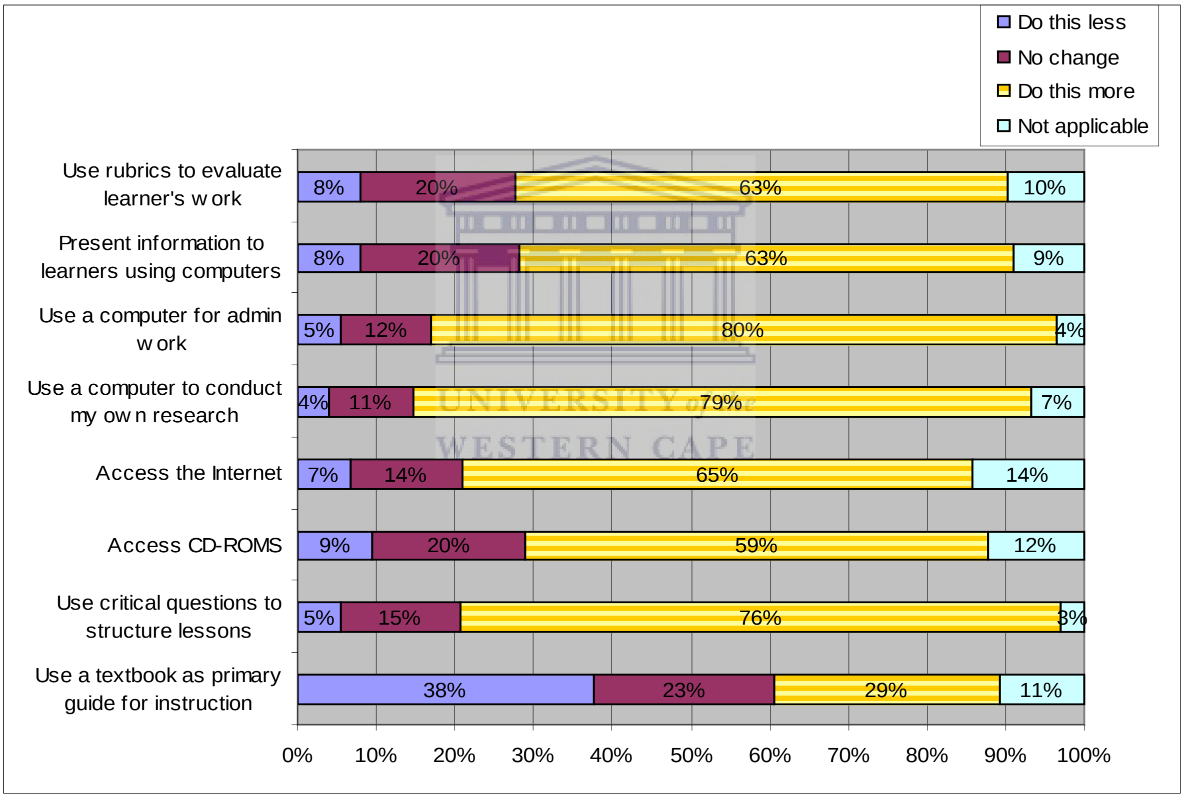

Figure 3.6: Changes in teaching practices (Strydom *et al.*, 2005, p.81)

As explained in Chapter 1, Outcomes-Based Education requires a more fact-finding, learner-centred approach to teaching. Therefore, the use of computer technology becomes imperative. It may then be assumed that the use of computers must respond to educators' needs, rather than the other way around.

Retrospectively, equipping educators with computer skills does not necessarily mean that educators will use computers to improve their lesson instruction in classrooms. At the same time, Koc (2005) found the lack of pedagogy in computer training to be inefficient as regards any initial educator training. In addition, trainee-educators bemoaned the fact that their instructors failed to address the key aspects associated with the pedagogical use of computers (Koc, 2005). Evidence from educational studies has been documented which shows that some educators are now starting to use computer technology to change their pedagogy and curricula (Schofield and Davidson, 2002; Means, Penuel and Padilla, 2001).

In the past, educators used to impart knowledge through teacher-centric methods. Now, through the use of computers, educators prepare projects, allow access to the appropriate resources and create structures and support systems that assist students in succeeding (Kozma, 2003; Martin *et al*., 2004). Thus, students are now empowered to tackle complex and more difficult problems by themselves. Sadly, education in South Africa, especially in black communities, is devoid of resources and any relevant pedagogy, and some educators are still imparting knowledge through a 'chalk and talk' mode (Hayman, 1999; Infodev, 2005).

A study by Preston and others (2000) has shown that educator pedagogies will always influence the learners' use of computers. This approach provides an authentic context for learning. Bransford, Brown and Cocking (2000) suggest that when educators empower students to learn by using computers, the emphasis moves away from the idea of learning by the rote memorisation of facts, towards learning as a process of knowledge creation.

Research studies have also begun to document the fact that many educators view computers as a resource to assist them in teaching the prescribed curriculum (Schofield and Davidson, 2002), while a few educators view computers as a way to change what is being taught, and how the learning of learners is assessed.

Accordingly, educator beliefs, computer resources and the ability of the educator to integrate computers into their lessons have changed the perceptions of educators' use of computers and technology in teaching (Cox *et al*., 2004).

In an international study of Technology and Classroom Practices by Kozma (2003), the conclusion was reached that educators in many countries are starting to use computers to assist changes in classroom teaching and to integrate computer technology into the curriculum. Educators are now utilising computers to change their role from the main source of information to one where they provide students with advice monitor their progress and assess their performance (Kozma, 2003).

Becta (2004) advocated that when educators have to implement new instructional strategies, the educators must be able to absorb new knowledge about computers and incorporate this new knowledge into the existing curriculum and existing pedagogies. However, it seems that some educators have used computers as a tool for teaching purposes instead of using them in the formation of a new integrated pedagogy.

The computer and pedagogy literature suggests that educators are currently developing higher levels of pedagogic repertoires as a result of using computers in their lessons; and they are prudently incorporating computer technologies into methods that are concomitant with their teaching plans.

Educator-training programs ought to prepare and provide support to educators and, in addition, challenge educators' beliefs regarding the way they teach their subjects and how the use of computers can enhance the way in which students learn (Cox and Marshall, 2007). Educators must be convinced of the value of computer technology as a supplement to enhance teaching and learning practices in the classrooms. Wozney and others (2006) postulate that computers must be systematically integrated into the curriculum, and not just added on.

Moreover, by implementing computers in this organised manner, it could be a trump card through which sceptical educators may develop positive beliefs on how computers can be used as a tool for teaching and learning (Wozney *et al*., 2006).

3.16 Summary

Chapter 3 has presented a discussion on the utilisation of computers in education. The in-depth investigation of the literature was intended to shed some light on the research questions that underpinned the investigation. Irrespective of the barriers observed, the use of computers has become a powerful tool in the professional development of educators. According to Saheb (2005), the use of computers reduces the isolation of educators by enhancing the teaching and learning environment and opening up to them an abundance of available resources worldwide.

The literature reviewed in all sections of this chapter has provided evidence of the complex nature of the use of computers in classrooms by educators, as well as the factors associated with it. Educators' theories and beliefs have strong influences on the use of computers in the classroom.

Educators, together with principals and school policies, determine the pedagogical approaches to teaching and learning.

Educator attitudes play an important role in the use of computers, irrespective of the advancement of technology and the various means of training that are available. Only through positive attitudes can the benefits of computer technologies be reaped.

Technologies in education are constantly changing, often too fast for educators to use them effectively. The literature revealed that there were many instances where educators refrained from using new technologies. It is therefore extremely important for educators to increase their computer skills since there are some learners clamouring for the use of computers in classrooms because they are using them daily and realise how useful computers can be.

The next chapter will discuss the implications of effective teaching and the role of computers in this process.

CHAPTER 4

FACTORS INFLUENCING COMPUTER USAGE OF EDUCATORS

4.1 Introduction

The theoretical framework for this study is based on the diffusion of innovations theory, which is supported by all the other theories, as discussed in Chapter Two. Many scholars consider Rogers to be one the most widely accepted researchers and theorists in the field of adoption and diffusion research since the publication of his book, *Diffusion of Innovations*, in 1962 (Ensminger; Surry, Porter and Wright, 2004).

Rogers' model will be used as a foundation in this study. However, the work of other scholars that improved on Rogers DOI theory will be incorporated to determine the variables and factors that influence secondary school educators to use computers for their lesson delivery. Building on the model of Rogers, the variables and factors that influence secondary school educators to use computers in their lessons have been extrapolated from the educational literature.

4.2 Correlation of factors related to Rogers' (2003) diffusion model

Based on the literature review in chapters 2 and 3, the following independent variables are relevant, namely: educators' theories and beliefs; educators' pedagogy; educators' support; educators' computer training; educators' access to computers and educators' attitude. These all seem to have a bearing on the innovation of computer usage in classrooms. The literature on the Diffusion of Innovations does not only serve to illuminate certain characteristics of this process, but also offers certain insights into why the process of using computers in education has become so complex an issue (Newhouse *et al*., 2002; Jacobsen and Lock, 2004; Finley and Hartman, 2004).

The use of computers by educators may be influenced by analytical models to recognise: (1) Their present level in the use of computers; and (2) factors that will increase their decisions to adopt computers into their classrooms (Clarke and Hollingsworth, 2002).

Rogers (2003) developed the model to include those elements necessary for studying how individuals adopt an innovation. He proposed the Diffusion of Innovations (DOI) theory.

4.2.1 Educators theories and beliefs in education with Rogers DOI

The characteristics of an innovation, as noted by users (see Chapter 2) to explain the difference in their rate of computer adoption, are linked to the first three steps in the innovation process, namely: relative advantage, compatibility and complexity (Rogers, 2003). In his book, Rogers (2003, p.287) summarised the characteristics of adopters under three headings: (1) Socioeconomic status, (2) personality values, and (3) communication behaviour. These will now be briefly discussed.

4.2.1.1 Socio-economic status

Rogers (2003, p.288) postulates that educators who tend to have positive intentions to adopt an innovation in the earlier stages, normally have "more years of formal education than do later adopters". In addition, he states that early adopters usually have bigger schools, and these schools are generally wealthier institutions. Furthermore, he states that there are more risks involved if the innovator is one of the first to adopt computers. These risks can be avoided by later adopters. Evidence in the literature suggests that educators do not have the time to take risks and are more appreciative of technology that works 'the first time' for them (Martin *et al*., 2004; Ward and Parr, 2010).

4.2.1.2 Personality variables

Rogers argues that educators who are among the first to adopt an innovation may be less dogmatic than are the later adopters. Dogmatism can be related to those educators who have very strong belief systems that are not easily compromised. Therefore, educators who possess highly dogmatic beliefs about computer technology not being successful are not likely to entertain computer innovations.

Furthermore, Rogers generalises that educators who are among the first to adopt an innovation, hold "more favourable attitudes towards change" and have higher aspirations for formal education, status and occupation (Rogers, 2003, p.290).

4.2.4 Communication behaviour

A critical aspect in the diffusion of innovation process is the way in which information is conveyed from one educator to other educators (Rogers, 2003). In particular, Rogers believes that the exchange of information between educators depends entirely on the circumstances of the educators, whether they will or will not transmit the information.

Consequently, if some educators believe that computer innovations will be unsuccessful, then this belief will be transmitted to other educators. Rogers believes that the quickest way of communicating computer technological ideas between educators is amongst those who are homophilous. He defines homophily as relating to those educators who share similar attributes, such as beliefs, social status and education (Rogers, 2003).

A disquieting observation in the literature suggests that, in the diffusion of computer innovations, educators are usually quite heterophilous. Furthermore, Rogers (2003, p.290) generalises that innovators' "interpersonal networks are more likely to be outside, rather than within, their system".

As depicted in the social interaction model (see Figure 2.15), he assumes that educators are involved in social educational networks that have an influence on their beliefs and attitudes towards computers. For example, a study by Medlin (2001, cited in Chapman, 2003, p.41) used Rogers (2003) DOI theory to identify factors that motivated faculty members to use computers in their instruction. Significant differences were found in the social, organisational and motivational variables. Included in the motivational variable were factors such as: interest in instructional technology, personal interest in improving the educators' teaching and personal interest in student learning.

The following section explains how Rogers' DOI theory can be linked to educators' use of computers.

4.2.5 Linking the DOI with educators' use of computers

4.2.5.1 Educators' access to computers

In his discussion of the attributes of innovations and their rate of adoption, Rogers (2003) argues that trialability and observability are two critical factors that must first be considered in order for an innovation to be successfully adopted. The scholar uses trialability and observation, issues that go beyond access, and states that the innovation must be able to be experimented with and the results should be observable to others. Rogers states that if an innovation could be designed in such a way that access is more readily available - then the rate of adoption would be greater.

The next paragraph explains how Rogers' DOI theory can be used to change the educators' attitudes towards the use of computers in the classrooms.

4.2.5.2 Educators' attitudes towards computers

Regarding the attitudes of the educators, Rogers (2003) argues that attitudes in many cases come between the adoption or rejection of an innovation. In simple words, the educators' attitudes or beliefs regarding the innovation have an impact on the decision-making process.

Almusalam (2001) argues that exposing educators to the use of computers would be of little use, if the educator has already formed an attitude that dictates that computers do not add any value to the lessons in the classroom.

The next paragraph explains how support of Rogers DOI theory can be used to assist educators in using computers in their teaching.

4.2.5.3 Educators' support in using computers

Rogers (2003) noted that the success or failure of diffusion programs and computer innovations is to a large extent dependent on the support from opinion leaders. During the innovation-decision process, educators and peers play important roles in the knowledge stage.

In this stage, educators are seeking information about the intricacies embodied in the innovation in order to reduce their uncertainty about the innovation.

During this stage, support from principals and educationists who have had previous experience, or been part of the initial process of the innovation, could allay such fears. In the persuasion stage, the educator increasingly seeks confirmation of the innovation's advantages and disadvantages as these issues apply to the educator's classroom situation. Rogers (2003, p.21) believes that "peers and near-peers" are the probable sources of this type of support and information.

The next paragraph uses Rogers DOI to indicate the importance of training when educators use computers in their instruction.

4.2.5.4 Educators' training

According to Rogers (2003), when individuals perceive the computer innovation as being more complex than their daily practical routine, this perception will affect the implementation, since it will require more training of the individual.

Bank's (2002) study used the DOI theory to explain the effectiveness of an institution's technological training program. The study, using Rogers' DOI theory, reported that technology enables educators to teach in new and better ways.

Blankenship's (1998) study of *Factors Related to Teachers use of Computers in Classroom Instruction*, used Rogers' DOI theory as a model to understand the use of computers in the classroom. The study reported that training was the most common predictor of adoption, followed by attitude, support, and access – as well as educator age.

The next paragraph uses Rogers DOI to indicate the importance of knowledge, and how it links to pedagogy when educators use computers in their instruction.

4.2.5.5 Educators' pedagogy and knowledge

Rogers (2003) argues that the knowledge stage of the innovation-decision process starts when a user becomes aware of the innovation and is knowledgeable of how it works (see Figure 2.8). He adds that there are three types of knowledge, namely: (1) Awareness-knowledge, (2) how-to knowledge and (3) principles-knowledge.

A study by Finley and Hartman (2004) used Rogers' DOI theory as a benchmark for assessing institutional change. The authors argue that, in order to adopt an innovation, individuals must be comfortable that they possess the required knowledge. In addition, they maintained that many educators disliked the fact that students having grown up as part of the digital era, know more about computers than they do. Finley and Hartman (2004) concluded that educators need to experiment with technology integration and see how it can be pedagogically useful. Moreover, Sang and others (2010) point out that there are factors such as the knowledge of computers and a sound pedagogy for the use of computers in education that could lead to an increased use of computers.

4.3 Additional factors regarding the use of computers in schools

4.3.1 First-order barriers

The classroom environment is complex and dynamic and places huge demands on educators, especially when they are trying to incorporate computer technology into their lessons. Ertmer (1999) describes the first-order barriers to technology integration as obstacles that are extrinsic to educators. Examples of first-order barriers are: lack of access to computers, lack of time, lack of technical support and the lack of training.

To concur with Ertmer, a study by Lim and Khine (2006) concluded that educators could not complete their lesson within a fixed time period due to computer hardware and software glitches that occurred during the course of the lesson.

4.3.2 Second-order barriers

On the other hand, second-order barriers are those obstacles that obstruct fundamental change in the attitudes of educators towards the use of computers (Ertmer, 1999). These barriers are normally seated in the educators' theories and beliefs and are not normally visible to others or even to the educators themselves (Lim and Khine, 2006; Ertmer, 2005). The authors state that either first-order or second-order barriers can block the use of computers by educators because the barriers can occur at different stages of the implementation process. Examples of second-order barriers include educators' theories and beliefs, their attitudes and educator intentions.

4.3.3 Educator time

A common problem that educators are confronted with is a lack of time to complete all their tasks during the normal working day. Learning new skills requires time for both professional and curricular development. However, educators do not have much time left after spending most of it on teaching, administrative duties, talking to parents and attending staff meetings (Fabry and Higgs, 1997; Lim and Khine, 2006; Martin *et al*., 2004).

In the uptake of computers in education literature, educators were concerned about the insufficient time available for learning the basics of computers, planning how to integrate technology into their lessons and physically using computers to conduct their lessons in classrooms (Cuban *et al.*, 2001). Accordingly, the authors observed that some of the dedicated computer-using educators sadly leave the teaching profession and migrate to other educational posts that offer them more time (Cuban *et al.*, 2001).

Moreover, Fullan (2001) avers that educators have continuously cited time as the recurring factor for being unable to use computers in education. A disquieting observation of Kirkwood and others (2000) found that educators were expected to train during their own time, and this resulted in a slow adjustment in their training schedule.

Respondents in the Becta (2004) survey agreed that the lack of time causes problems in using computers. They reported that their training also suffered as a result (Jones, 2004)

Other researchers (Martin *et al*., 2004) also indicated that a lack of time for educators to use computers was a barrier to their effective use of computers. Moreover, they stated that school leaders must address this issue. Supporting evidence in the ICT literature reflects the truth that educators require time to prepare lessons, engage in in-service training and discover new information for themselves (Jones, 2004; Kirkwood *et al*., 2000; Koc, 2005).

Contrary to the above, Rice, Wilson and Bagley (2001) report on the finding of a particular educator who went the extra mile to overcome the barriers of time to using computers during his lessons, regardless of the discouragement of the school principal. The authors reported that this educator spent much of his own time outside the working hours of the school in increasing his knowledge and skills as regards computers. Moreover, this educator found ways and means to incorporate the use of computers into his lessons.

Therefore, if educators are motivated to use computers in their lessons, they will find the time to do so. Educators require sufficient time to learn, test, integrate, experiment with computers and reflect on how they will use computers in the classroom.

Generally, a few researchers have stated that educators must have sufficient time to implement new technologies into the classrooms (Koc, 2005; Afshari *et al*., 2009; Dawson, 2000). Sufficient time must be provided for educators to nurture new computer skills and experiment with the use of computers so that they can integrate the use of computers into their existing teaching habits (Mumtaz, 2000).

To overcome this time barrier Snoeyink and Ertmer (2001) suggested that educators should have dedicated times during school hours set aside for training purposes.

4.3.4 Educator experience

In terms of this research, experience is regarded as how long an educator has been active in the teaching profession. A simple explanation for experience is the knowledge or skill that human beings have acquired over time (Oxford Dictionary, 2010). The literature presents contradictory views regarding the influences of experience on computers in education.

A study by Sultan and Chan (2000) hypothesised that experience has an influence on decision-making; however, their results did not consistently support this. On the other hand, Bandura (1982) found that experience enabled people to make meaningful contributions to innovative decisions.

The Hadley and Sheingold (1993) study reported that experienced educators (ranging from two to six years of experience) were using computers for three reasons: Firstly, to get learners to create their own products; secondly, to allow learners to explore computer programs by themselves; and thirdly, to explain an idea or skill to a learner.

Educators with less than two years of experience often used the approach of allowing learners to explore programs on their own. Educators who were gaining experience only used the computer to explain an idea or skill to the learner, while inexperienced educators tended to use computers more frequently for game-like drills (Hadley and Sheingold, 1993).

Another study by Becker (2000) compared educators who were making full use of computers with others who were not. Furthermore, his research provided insight into the factors concerned with the use of computers between experienced and inexperienced educators. These findings are relevant to the present study. In addition, his study highlighted the attitudes and behaviour of the experienced educators and the factors relating to them. Becker’s study revealed that experience itself does not necessarily guarantee the successful use of computers in teaching.

A limitation to Becker's study was that it did not provide information about those 'other computer-using' educators who were trying to use computers for lesson delivery.

4.3.5 Educator confidence and anxiety towards computers

As the use of computers increases in schools, the unfounded assumption could be made that educators have the confidence to use computer technology effectively. A few researchers (Jones, 2004; Mueller *et al.,* 2008; Eteokleous, 2008) lament that there is sufficient evidence to suggest that educators in many countries are not confident in their use of computers. Moreover, they assert that between one third and two thirds of educators, who were not using computers, did so because they lacked confidence, or had a fear of computers. Many educators, who consider themselves as lacking in computer skills, feel anxious when using computers in their classrooms and are aware that some of their students know more than they do (Jones, 2004; Guha, 2000).

A study in Swiss schools found that when educators had to integrate computers into their teaching they had to adapt to the new roles of coach and facilitators of learning (Buettner, 2006). These educators had to deal with their own fears of not being computer literate, and in many instances had to resort to receiving assistance from their students who had superior computer knowledge. Buettner's study reported that only 26% of educators used the internet regularly during their lesson delivery, 38% seldom, and 35% never - despite the fact that 93% of educators had an internet connection at school and at home. Buettner (2006) concluded that most of these Swiss educators were lacking in confidence and were still situated in the 'integration' stage. This meant that special efforts had to be made for in-service educators concerning computer didactics. Buettner (2006) found in her study that many educators felt anxious when using computers because they perceived themselves as lacking in confidence when working with computers.

Researchers in the Hadley and Sheingold (1993) study found that 88% of educators changed their teaching habits by using computers. Educators found that learners were producing higher quality work by using computers and believed that their learners were grasping difficult concepts and developing higher thinking-order skills.

The Becta (2004) survey of practitioners found that 21.2% of the total responses were linked to a lack of educator confidence and several other barriers as well (see Figure 4.1). In Figure 4.1 the direction of the arrows represents the phrase 'can lead to'. The double-headed arrows show that confidence can be affected by the three related barriers. The darker arrows on the diagram show that some factors that are related to the barriers, can be interrelated (Jones, 2004, p.21).

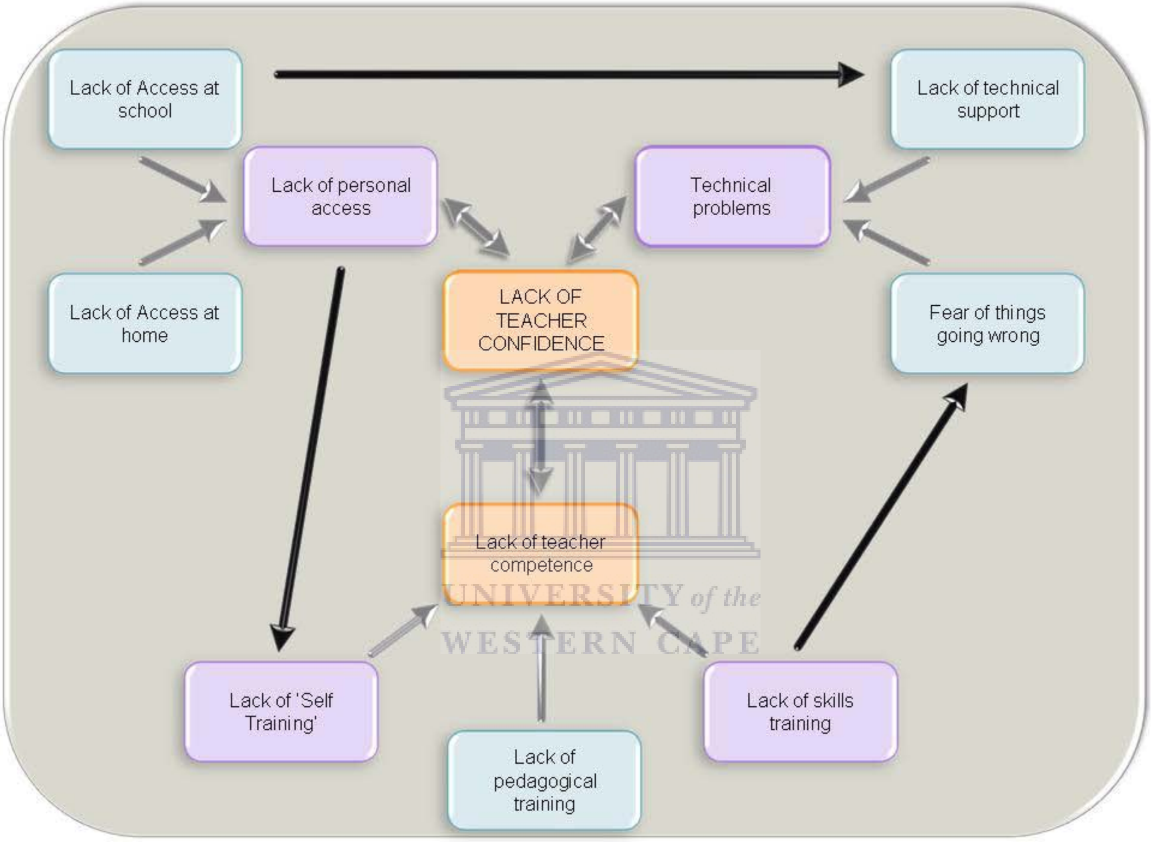

Figure 4.1: Relationships between confidence levels and other barriers (Jones, 2004, p.21)

A study by Bosley and Moon (2003) confirmed that there were inconsistencies between the level of computer training and the extent to which the educator applied this training during his/her lesson delivery. The authors asserted that some educators did not have the confidence to put their new learning into practice. Accordingly, it seems that there are some educators who have a fear of computers (computer anxiety), which can be a genuine concern for educators (Roslan and Mun, 2005).

According to Roslan and Mun (2005), a common cause of cyberphobia is being stymied while using computers, and not knowing what the next step is. Furthermore, educators did not understand all the computer terminology and the error messages.

A lack of confidence, as a barrier to the use of computers in the classroom, can be linked to other key issues – some of which can also be seen as obstacles to educators' use of computers. For example, educators' confidence in using computers can be directly related to the amount of personal access educators have had to computers (Guha, 2000; Cox *et al*., 1999).

The fear of computers malfunctioning during lessons in classrooms has a direct effect on educators' confidence levels (Cuban, 1999; Roslan and Mun, 2005; Orr, Allen and Poindexter, 2002). Accordingly, the lack of educator competence or the educators' perception thereof, and the type of training that educators received, all play significant roles in the educators' confidence regarding the use of computers (Roslan and Mun, 2005; Orr *et al*., 2002; Lee 1997).

In another study, Computers for Teachers (CFT), a government initiative in England aimed to raise technology standards and assist educators in having access to computers (Becta, 2001). The study revealed that 96% of educators, who bought personal computers through this scheme, raised their confidence levels, their competence and their skills in the use of computers in their teaching (Becta, 2001, p.4).

Furthermore, it was noted that before the CFT scheme, 58% of educators were using computers in their teaching. After the CFT scheme was introduced, this figure increased to 89%. A huge majority of educators in the CFT study recognised that computers could add value to their teaching and classroom practices.

Many educators are starting to purchase their own laptops, and this will inadvertently boost educator confidence in the use of computers during lesson delivery (Scrimshaw, 2004). Adequate training of educators is essential to ensure that they feel competent in what they are doing. Observing other more experienced educators in 'real life' situations is useful as well.

A review of studies on educator attitudes reported that educator confidence had the greatest impact on the use of computers in schools, compared with other variables such as access, support and time (Hardy, 1998; Jones, 2004; Pamuk and Pekar, 2009).

4.3.6 Educators' resistance to change

A good deal of the literature regarding inhibiting factors in the use of computers in education indicates a general resistance to change (Jones, 2004; Johnson, *et al*., 2009). Moreover, these scholars state that educators are often suspicious of a new idea if there is no proof of its effectiveness and will only adopt a new technology when it helps them to improve what they are currently doing.

In other studies, Young (2000) and Koc (2005) noted that pre-service educators often resisted new technologies and indicated a lack of motivation because they were not confident in using computers. Furthermore, they refused to acknowledge the value that computers could add to curricula and they argued that their reluctance to use computers was on account of poor quality software and their inadequate computer training.

Clark (2000) stipulates that training programs should not only be designed to improve computer skills, but should also aim to address educators' resistance to the use of computers in their instruction.

King (2002) studied how educators experienced transformational learning and examined their beliefs about teaching and learning while learning educational technology. Her study confirmed that technology did change the educators' perspective on their profession. King regards this as an important finding - seeing that resisting change is a state of mind for most educators and one of the difficult barriers to overcome in the use of computers in schools.

Resistance to change is not merely related to the educators' attitudes and beliefs, but as Cuban and others (2001) argue, the actual school environment may act as a barrier to the successful use of computers in classrooms.

4.3.7 External pressures

With the introduction of Outcomes-Based Education (OBE) into South African schools, a radical change in the educators' style of teaching became necessary. The South African Department of Education implemented a new policy named Curriculum 2005. This advised educators on how to implement OBE in classrooms (DoE, 2003).

However, meeting the objectives of the e-Education White Paper (DoE, 2003) is not an easy task, especially where many educators have poor education themselves.

In the words of the Department of Education (2002, p.6):

> "Most reports on South African education indicate that the majority of teachers have not yet been sufficiently equipped to meet the education needs of a growing democracy in the 21st century global environment."

Computer infrastructure in South African public schools still remains under-resourced, even though much improvement has already taken place (Wilson-Strydom, 2007). In addition, she believes that there are still many schools with no or few computers available for teaching.

Other pressures experienced by educators are the huge administrative duties and extramural activities for which educators are responsible. These duties and pressures could encroach on their drive to use computers in teaching. While some educators have resisted using computers in classes, others have welcomed them. However, in many instances, it seems that most educators feel under-prepared to utilise computers as a curriculum tool.

Consequently, it is clear there are increasing external pressures and a steadily increasing need for change.

4.3.8 Educator intent

The overall intent of educators is to ensure that they can decide when, where, when not, and how to use computers to attain their classroom learning objectives.

Fullan (2001) advocates that in order for change to happen, educators must understand themselves, while others must understand educators' intentions. According to Watson (2001), most educational theories of change assert that once small cohorts of innovators emerge, their adoption of the innovation will filter through to their peer group of educators.

Watson states that this uptake of computers into teaching is not happening. It appears that this could be a reality. Fullan's (1991) argument is that the more committed an individual is to change, the less effective the individual becomes in motivating others to implement the innovation.

Educators who are successfully using computer technology in their classrooms are not necessarily more competent or have more access, time or resources than other educators (Zhao and Cziko, 2001). These proactive educators work well in advance of any significant support from the educational system by making use of their own personal finances (Schrum, 1995). Therefore, only a few educators are 'adventuresome' with positive intentions to use computers in their classrooms.

Additional evidence supports the argument that a lack of preparation causes the lack of educator adoption of technology. This explains why some educators refuse to use the computer resources provided. For example, one secondary school educator retorted that he was an old-fashioned type educator and had over the years built up a file on the subjects he taught. For him to teach using computers, he would have to start all over again. He concluded that he did not want to change and had no intention of doing so (OTA, 1995). It is difficult to understand why some educators were willing to spend their own money to use computers in the classrooms (Schrum, 1995), while others were not even using the computers already provided for them (OTA, 1995). There are some educators who may refuse to integrate the use of computers into their teaching, because they feel threatened by the impetus these add to educational reform (Fuller, 2000).

In addition, there will always be a few educators who will be sceptical about using computers in their classrooms owing to "philosophical oppositions" (Finley and Hartman, 2004, p.323).

4.4 Dependent and independent variables

The following tables highlight the six independent variables and the dependent variable with the corresponding supporting authors, which have been extrapolated from Chapters 3 and 4. Tables 4.1 to 4.7 present some of the authors of the literature for the corresponding six independent variables and dependent variable. Only a few randomly selected authors in the supporting literature were selected for these tables. Thereafter a model (see Figure 4.2) for the current study is presented.

Table 4.1 Educators use of computers and supporting literature

Educator use of computers (dependent variable)	
Definition: How proficient educators are when using computers in the classrooms.	
Martin *et al*., 2004; Jegede, 2009; Smarkola, 2008; Baylor and Richie, 2002; Pelgrum, 2001.	
Author	**Contribution**
Martin *et al*., 2004	Argues that computer technology requires educators to acquire new technical knowledge and skills and to change their instructional practices.
Jegede, 2009	More focused and educator targeted computer training content is required because the training that was offered on word processors and databases have no impact on classroom practices.
Smarkola, 2008	Pre-service educators have limited understanding of how computers can be used as a tool to enhance their teaching.
Baylor and Richie, 2002	Educator training courses often focused more on basic computer literacy skills and less on the integrated use of computers in teaching.
Pelgrum, 2001	Educators' lack of skills is the second highest obstacle to the use of computers in schools.

Table 4.2 Educator pedagogy and supporting literature

Educator Pedagogy	
Definition: Pedagogy refers to how educators impart knowledge to learners	
Saheb, 2005; Lim and Chai, 2008; Sang *et al*., 2010; Ward and Parr, 2010; Fullan, 2001; Cox, 2000; Fuller, 2000; Drenoyianni, 2006; Carlson and Gadio, 2002; Pierson, 2004; Hardman, 2005; Sánchez and Salinas, 2008; Strydom *et al*., 2005; Lundall and Howell, 2000; Hawkridge, 1990; Carnoy, 2004; Williamson, 2003; Infodev, 2005; Preston, 2000; Cox *et al*., 2004; Niess, 2005; Hayman, 1999; Infodev, 2007; Koc, 2005; Schofield and Davidson, 2002; Means Penuel and Padilla, 2001; Kozma, 2003; Bransford *et al*., 2000; Becta, 2004; Newhouse *et al*., 2002; Rogers, 2003.	
Author	**Contribution**
Niess, 2005	Development of overarching concepts of teaching material.
Sang *et al*., 2010	Computers as pedagogical tools offer many advantages over traditional methods of teaching.
Fullan, 2001	Educators are responsible for deciding whether to implement the innovation or not.
Fuller, 2000	The use of computers in education acts as an excellent teaching tool.
Newhouse *et al*.,2002	Benefits and complexities of using computers in teaching.
Cox, 2000	Progress towards the use of computers and their integration into education.
Ward and Parr, 2010	Professional development must increase pedagogical motivation for teachers to integrate computers in their teaching.
Saheb, 2005	Use tools that extend the quickest methods of learning in an interactive atmosphere.

Table 4.3 Educator theories and beliefs and supporting literature

Educator theories and beliefs	
Definition: Assumptions based on limited information and vague ideas in which confidence is placed.	
Pownell and Bailey, 2000; Jones, 2004, Govender, 1999; Sugar *et al*., 2004; Strydom *et al*., 2005; Baylor and Ritchie, 2002; Haddad and Jurich, 2002; Brown, 2009; Zhao and Cziko, 2001; Kellner, 2000; Drenoyianni, 2006; Becker, 2000; Richardson, 2003; Zhao and Cziko, 2001; Lim and Khine, 2006; Guha, 2000; Bosely and Moon, 2003; Wild, 1996; Fullan, 2001; Mueller *et al*., 2008; Hadley and Sheingold, 1993; Byrom and Bingham, 2001; Ward and Parr, 2010; Byrd and Koohang, 1989; Bai and Ertmer, 2008; Rogers, 2003.	
Author	**Contribution**
Drenoyianni, 2006	Computers offer change to more progressive practices.
Becker, 2000	Educators' who have more traditional beliefs, tend to use computers less often than those with student-centred beliefs.
Lime and Khine, 2006	Computers are used as a teaching tool to break the monotony of 'chalk and board'.
Haddad and Jurich, 2002	The use of educational videos can be used to mentor pre-service educators.
Zhao and Cziko, 2001	The use of computers necessitates educators to adopt different teaching styles.
Byrd and Koohang, (1989)	Students motivated educators to change their method of teaching due to students' positive learning outcomes.
Mueller *et al*., 2008	Educators first want to experience positive outcomes when using the computer to teach before altering their beliefs.

Table 4.4 Educator access and supporting literature

Educator access	
Definition: Methods by which educators can get to a computer to conduct their work.	
Strydom *et al*., 2005; Lundall and Howell, 2000; Fullan, 2001; Van Belle *et al*., 2004; Guha, 2000; Pumak and Peker, 2009; UNESCO, 2002; Howie *et al.,*2005; Drenoyianni, 2006; Pelgrum and Plomp, 1993; Balanskat *et al*.,2006; Jones, 2004; Bosley and Moon, 2003; Guha, 2000; Clark, 2000; Mueller *et al*., 2008; Bates, 2000; Gordon, 1997 ; Williams *et al*., 2000 ; Eteokleous, 2008; Becta, 2004 ; Pelgrum, 2001 ; BESA, 2000 ; Preston *et al.,* 2002; Becta, 2003; Newhouse *et al*., 2002; Bosley and Moon, 2003; Cox *et al*., 1999; Rogers, 2003.	
Author	**Contribution**
Eteokleous, 2008	Lack of access to computer resources is a barrier to the use of computers in schools.
Guha, 2000	Educators' confidence will increase based on the amount of personal access to ICT.
Williams *et al*., 2000	Prior access to computers increases the motivation to the use of computers.
Pumak and Peker, 2009	Educators who do not have access to computers have lower levels of confidence when using computers.
Strydom *et al*., 2005	Reasons for not implementing technology integrated lessons in schools are due to insufficient availability and access to computers.
Mueller *et al*., 2008	Lack of access to computers causes a hindrance to effective use of computers in schools.

Table 4.5 Educator support and supporting literature

Educator support	
Definition: Computer assistance by colleagues, the administration and external computer companies.	
Strydom *et al*., 2005; Lundall and Howell, 2000; Van Belle *et al*., 2004; Newhouse, 2001; Schiller, 2003; Fullan, 2001; Sánchez and Salinas, 2008; Jackson, 2000; Madingoane, 1999; Hadley and Sheingold, 1993; Clark, 2000; Tondeur *et al*., 2007; Yee, 2000; Smarkola, 2008; Reynolds *et al*., 2003; Grove et al., 2004; Scrimshaw, 2004; Preston *et al*.,2000; Twining *et al.,*2006; Becker, 2000; Butler and Sellbom, 2002; Cuban *et al*., 2001; Cox *et al*., 2004; Snoeyink and Ertmer, 2001; Rogers, 2003.	
Author	**Contribution**
Reynolds *et al*., 2003	Support from external sources increases educators' confidence to use computers.
Hadley and Sheingold, 1993	Educators work in supportive environments so that ideas about the use of computers may be shared.
Butler and Sellbom, 2002	Reliability of support is important and classrooms must be set-up as similar as possible.
Preston *et al*., 2004	Due to the complex nature of computers, educators require ongoing and follow-up support.
Smarkola, 2008	Experienced educators depend on having collegial support from the administration to successfully use computers in schools.
Afshari e*t al*., 2009	Principals must develop programs to support educators' use of computers.
Twining *et al*., 2006	Support can be narrowed down into three sections: robust technical support; just-in-time support and professional development support.

Table 4.6 Educator training and supporting literature

Educator training	
Definition: Computer training for educators by WCED or external sources.	
Strydom *et al*., 2005; Lundall and Howell, 2000; Jones, 2004; Fullan, 2001; Galanouli *et al.,* 2004; Duggleby *et al.,* 2004; Becta, 2002; Fullan, 1991; Balanskat *et al.,* 2006; Pelgrum and Plomp, 1993; Brown, 2009; Galanouli *et al.,* 2004; Crawford, 2000; Strudler *et al*.,1999; Sang *et al*., 2010; Sheingold and Hadley, 1990; Pamuk and Pekar, 2009; Selwyn, 2000; Abbott and Faris, 2000; OFSTED, 2002; Smarkola, 2008; Carnoy, 2004; Dawson, 2006; Vannatta and Beyerbach, 2000; Eteokleous, 2008; Barton and Haydn, 2006; Molebash, 2004; Wetzel, 1993; Koc, 2005; Jacobsen and Lock, 2004; Brown and Richie, 1991; Miller *et al*., 2004; Preston *et al.*, 2000; Karelse and Sayed, 1999; Dawson et al., 2004; Pelgrum and Law, 2003; Fullan, 1991; Baylor and Ritchie, 2002; Waite, 2004; Kirkwood *et al.,* 2000; Preston *et al*., 2000; Rogers, 2003.	
Author	**Contribution**
Lundall and Howell, 2000	Lack of trained educators remains a barrier to the start-up and effective use of computers in schools.
Jones, 2004	Factors such as lack of time for training and lack of pedagogical training must be considered.
Zhao, 2007	The lack of training is the second highest barrier when integrating computers into schools.
Carnoy, 2004	Training is a costly process to ensure that educators' are 'computer-savvy'.
Galanouli *et al*., 2004	Training is successful when it is seen as a school priority.
Sang *et al*., 2010	Unwillingness of younger educators to use computers in their classrooms due to the quality of the training they receive.

Table 4.7 Educator attitude and supporting literature

Educator attitude	
Definition: The educators' approach towards the use of computers for teaching.	
Fuller, 2000; Jones, 2004; Bialobrzeska and Cohen, 2002; Ajzen, 1975; Ajzen and Fishbein, 1980; Bandura, 1977; Duggleby *et al*., 2004; Kay *et al*., 1999; Dexter *et al*., 1998; Jansen and Christie, 1999; Young, 2000; Jawahar, 2002; Jawahar and Elango, 2000; Chau, 2001; Jhurree, 2005; Eteokleous, 2008; Clark, 2000; Sánchez and Salinas, 2008; Newhouse *et al*., 2002; Bliss *et al*., 1986; McLeod *et al*., 2002; Kitchen, 2007; Rogers, 2003.	
Author	**Contribution**
Bialobrzeska and Cohen, 2002	School principals are critical agents of change therefore the principals' attitude towards the use of computers must change as well.
Duggleby *et al*., 2004	Changing the attitudes of the educators is critical to ensure the success of online teaching courses.
Jawahar and Elango, 2001	There is a difference between attitudes towards computers and attitudes in working with computers.
Eteokleous, 2008	Educators with low usage of computers tend to have negative attitudes towards computers.
McLeod *et al*., 2002	Attitudes between male and female educators towards the use of computers have converged to a point where there is no significant difference.
Bandura, 1977	Attitudes towards computers have an impact on educators' self-efficacy.

Based on the supporting literature in Chapter 3 and Chapter 4, the six independent variables are hypothesised to have some effect on the use of computers for teaching by secondary school educators in the Western Cape central metropole. The proposed research model is depicted in Figure 4.2 below, followed by generation of the hypotheses for the present study.

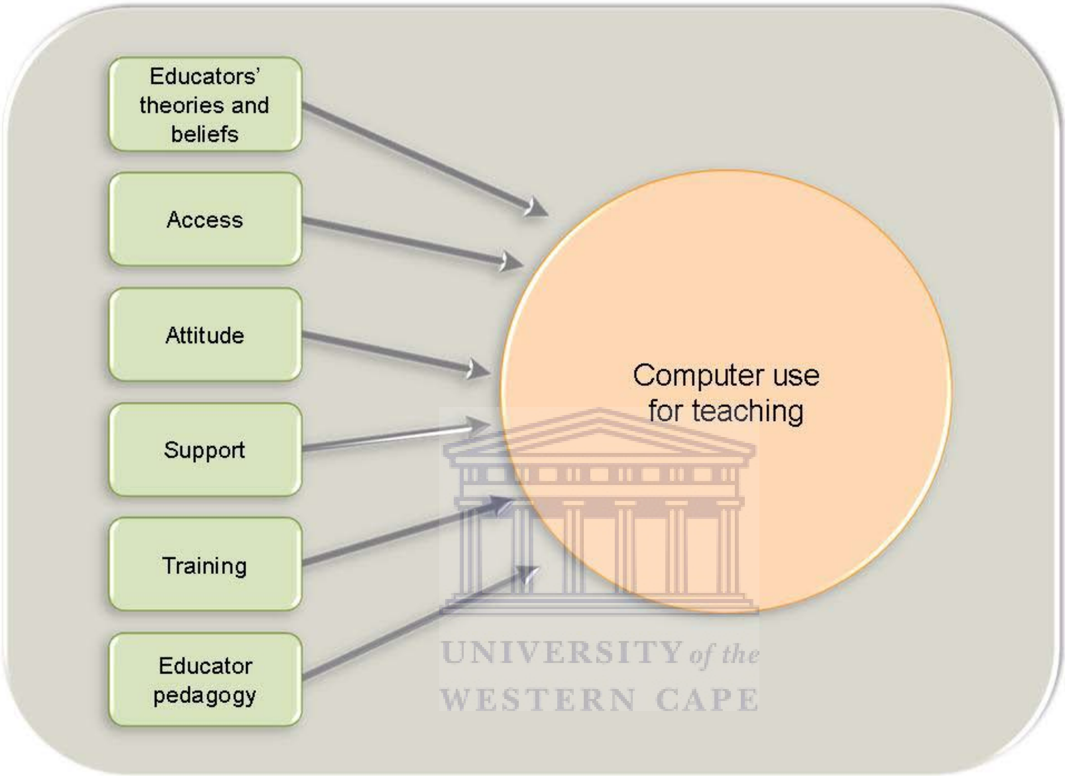

Figure 4.2: Proposed research model for the present study

4.5 Integration of literature and generation of hypotheses

This section reviews the hypotheses concerning the use of computers for instructional purposes in classrooms. In addition, these hypotheses are based on previous models and theories relating directly to educators. Six important variables have been identified through logical reasoning during the building of the theoretical framework. This allows for the scientific testing of relationships through the appropriate statistical analysis. The formulation of such testable statements is called 'hypothesis development' (Sekaran, 2003).

4.5.1 Educators' theories and beliefs

Schools and educators are under considerable pressure to change. Educators have reported varying attitudes to the use of computers, ranging from supportive to negative. However, there is an acceptance that cannot simply be overlooked. It will also be important to consider all aspects of the educators' beliefs, resistance and the anxieties that many express towards the use of computers.

Many of these barriers may hinder any attempts to initiate research regarding the use of computers. Therefore, researchers should be aware of these barriers and be prepared to deal with them. One of the research interests in this study was the relationship between educators' theories and beliefs and the impact this had on the use of computers in classrooms. Educators' beliefs may be affected by their internal resources and may therefore have an impact on their attitudes about teaching and learning and their professional development. The use of computers by educators, which is the focus of this study, has the potential to change educators' theories and beliefs, especially about learning how to use computers and their role in the classroom. These beliefs are important in decision-making where there has been innovation or any uncertainty.

Therefore, Hypothesis One states:

H_1: There is a significant correlation between computer utilisation for teaching purposes by secondary school educators in the Western Cape central metropole and educators' theories and beliefs.

4.5.2 Educators' access to computers

The review of the literature suggests that educators at some schools have access to computers - whether this is at school, at home or elsewhere. Since the literature has revealed that computer access correlates with the educators' use of computers in the classroom, access to computers will be used as a variable in this study. It would be mischievous not to mention that educators concur that computer technology is a potentially powerful new teaching and learning tool.

For example, where schools are rich in technology environments, educators believe there are significant educational outcomes that could not be easily achieved without significant access to computers (Newhouse, 2001; Martin *et al*., 2004). Inferences can be made that using the most up-to-date hardware and software will be a key attribute in the diffusion of innovations. Many scholars have suggested that the shortage of funds to obtain the required hardware and software has been one of the critical reasons why educators are reluctant to use computers in their classes (Mumtaz, 2000).

Therefore, the effective use of computers depends on the availability of hardware and software and access to all computer resources by educators and administrative staff.

Therefore, Hypothesis Two states:

H_2: There is a significant correlation between computer utilisation for teaching purposes by secondary school educators in the Western Cape central metropole and educators' access to computers.

4.5.3 Educators' attitudes towards the use of computers

A few authors have highlighted the criticality of educators to the transformation process, since educators can support or undermine transformation by their personal actions in their own classrooms. Equally important are the educators' own attitudes towards using computers and their own reform, and the fact that unnecessary obstacles can interrupt or undermine their best intentions. Some authors believe that attitudes are based on knowledge, affective reactions and current and past behaviours, thereby influencing future knowledge, affects and behaviours towards the use of computers (Dusick, 1998; Jones, 2004; Ajzen and Fishbein, 1980; Kitchen *et al*., 2007). Educator attitudes also have their own implications. A few scholars believe that the successful use of computers in classrooms is dependent on positive teacher attitudes towards computers (Jones, 2004, Rogers, 2003; Duggleby *et al.,* 2004; Macleod *et al*., 2002).

Clarke and Hollingsworth (1994, cited in Birks, 2005) believe that change in the educators' practice occurs only when educators alter their beliefs and attitudes about elements of their practice. Here one might argue that this change must emanate from within the educator. A few authors (Jawahar, 2002; MacLeod *et al*., 2002; Cox *et al*., 1999; Chau, 2001) argue for the need to embrace computer technology, and that educators must have positive attitudes towards the innovation and feel self-confident about using it. Educators devote most of their time and effort towards the progress of their students, and care should be taken that educators' own needs are not overlooked.

Therefore, positive attitudes towards the use of computers will be increased when educators are confident and comfortable with computer technology and are knowledgeable about its use. It could therefore be specifically hypothesised that attitudes towards computers will be positively associated with computer use.

Therefore, Hypothesis Three states:

H_3: There is a significant correlation between computer utilisation for teaching purposes by secondary school educators in the Western Cape central metropole and educators' attitudes towards computers as a medium of instruction.

4.5.4 Educators' support in using computers

Collaboration among educators can be regarded as supportive, as well as it being also a helpful learning tool. Supportive techniques may reduce the educators' feelings of computerphobia, anxiety and increase their use of computers by the simple process of sharing the same problems and finding that other people have similar issues (Fullan, 1993b; Twining *et al*., 2006; Preston *et al*., 2000). Complex computer innovations in schools need to rely on as much support and symbiotic activity as is possible. Fullan (1993b) argues that schools that have stronger social networks, display higher consensus behaviour and a focus that is more educational. Moreover, educators could periodically meet in social groups to plan activities, monitor progress and maintain interest, as well as to support each other's efforts.

Educators could be encouraged to support each other and to attempt to establish broad-based support systems at the local school level (Fullan, 1999; Smarkola, 2008). In addition, it was reported that the lack of support was one of the barriers that resulted in computers being underutilised in classrooms (Lundall and Howell, 2000). Therefore, some educators have refused to use computers because they were unsure where to find support when something went wrong while using them.

Therefore, Hypothesis Four states:

H_4: There is a significant correlation between computer utilisation for teaching purposes by secondary school educators in the Western Cape central metropole and educators' support for using computers in classes.

4.5.5 Educators' training in computers

The literature indicates that there is a drive to increase the availability of computers in classrooms and to provide resources and guidance to educators, as well as training in the integration of computers into the curriculum. However, many educators were dissatisfied with the training they had received (see 3.15.5). Evidence in the literature has also indicated that out of frustration many educators are teaching themselves how to use computer technology. The availability of computers and the use of the Internet have slowly increased in many schools and classrooms (Buettner, 2006; Martin *et al*., 2004).

It may be argued that this increase in computers and internet usage are coupled with initiatives towards understanding how best to use computers to improve the teaching, learning and training of educators to use computers effectively (Pownell and Bailey, 2000; Todd, 1997). In order to use computers effectively in their everyday teaching, educators need to understand how to harness the power of the computer and training on how to apply this tool. With appropriate support and training, educators will be better informed and have less anxiety about the use of computers. Shulman (1986) posits that educator-training programs should not be aimed at training educators to practise in a prescribed manner, but should rather encourage educators to 'reason soundly' about their teaching, as well as to teach skilfully.

As new computer technologies become more and more sophisticated, the transition and integration into curricula becomes increasingly difficult, thereby requiring more training before educators can use such innovation effectively.

Hence, insufficient preparation to use computers can be a reason why educators do not systematically use computers in their classes. Training will thus be used as a variable in this study since the literature suggests that training is a critical aspect in educators' adoption and use of computers in their teaching.

Therefore, Hypothesis Five states:

H_5: There is a significant correlation between computer utilisation for teaching purposes by secondary school educators in the Western Cape central metropole and training for educators on how to use computers in their classes.

4.5.6 Educator pedagogy

Evidence in the literature suggests that the use of computers in classrooms has some interactive relationship with different pedagogical styles (see 3.15.6). In examining the computer and education literature, it became evident that some educators develop a more constructivist pedagogy through working jointly with other educators who face similar challenges (Solvie and Kloek, 2007; Chien-Sing, 1999). For this study the prospect that the use of computers could have contributed to educators changing their pedagogical style is important. For example, increased student involvement with computers can improve student learning and satisfaction. With their use, computers can increase the depth and breadth of educator beliefs on learning and other pedagogical topics (Mueller *et al.*, 2008; Smarkola, 2008).

Mavaresh (1996, cited in Clarkson, 2002) believed that until educators learn to use technology better, they must inevitably endure a short-term drop in self-confidence, even though they might expect a rise in skills and personal competencies at a later stage. This depiction explains why educators are unwilling to start their personal change process, irrespective of its duration. Some scholars believe that these transitions in pedagogy may take several years or they may happen within a year Richardson and Anders (1994, cited in Clarkson, 2002).

Therefore, Hypothesis Six states:

H_6: There is a significant correlation between computer utilisation for teaching purposes by secondary school educators in the Western Cape central metropole and educators' pedagogy.

4.6 Summary

A careful selection of studies has been discussed - presenting various factors that might have an influence on the use of computers by educators. Some researchers argue that these factors must be further investigated, as there are complex relationships between them. If the factors identified by researchers are not properly investigated, the use of computers in education for instructional purposes will continue to be slow.

The issue of training is complex and there are many factors which can be considered important in ensuring that training is effective. Many educators are embarrassed when computers malfunction during lessons, and they then lose interest - as soon as they experience any hardware and software issues. Successful models of computer professional development must consider a range of ideas. These should include sufficient time, technical and administration support and modern equipment and resources.

Educator input in course content and the selection or evaluation of educational programs is critical to ensure appropriateness in their teaching practices.

Educators are currently striving towards harnessing the use of computers to support their activities in the classrooms - in spite of operational constraints. Increased development will depend on the provision of more time and reliable access to computer resources. Educators must develop positive attitudes towards computers. An incentive should be in place to motivate educators to use computers.

There should be a drive to transform educators' perspectives on the profession by including the use of computers as a tool. Although there are similar theoretical strands in contemporary educator programs, each program has its own unique attributes. Therefore, the integration of computers into curricula must also be unique.

Finally, the literature reviewed in this chapter has focused on Rogers' diffusion of innovations model, various research strategies and suggestions concerning the use of computers in classrooms and how educators' adaptation can be encouraged.

Attention is drawn to the fact that technology lends itself to exploration, and there are numerous issues involved in the introduction and integration of computers into classrooms by educators.

Some of these include:

- Change and educators' ability in coping with technological change;
- Educator resistance to change;
- The impact of technology on teaching and learning;
- Educator pedagogies;
- Integrating technology into classrooms;
- Barriers to technology use by educators; and
- Educators' theories and beliefs

Now that the hypotheses have been formulated, the next chapter will present the design and methods used in this study.

CHAPTER 5
RESEARCH METHODOLOGY

5.1 Introduction

This chapter describes the research methodology of the current study. The literature review in Chapter Four has elucidated the field in respect of the basic constructs of the study. Hussey, J and Hussey, R (1997) stated that there are numerous types of research, such as exploratory, descriptive, analytical predictive, quantitative, qualitative, deductive, inductive, applied, and basic research.

Research methodology is the description of the paradigm, approach, design and the rationale for data collection that will enable the researcher to discover new knowledge. Furthermore, research design is a creative process that reflects the personal preferences of the researcher. At the same time, there are guidelines for designing a research project that individuals in the field would concur are the essential components of that specific activity.

Leedy (1993) avers that whichever methodology is selected will depend on the overall level of rigour that is being sought, the constraints placed on the researcher and the resources available to perform the research.

Researchers, irrespective of the type of research they intend to undertake, need to focus their efforts on answering two important questions. Firstly, what methodologies and procedures will be used in the research? Secondly, how does one justify this choice and the use of these methodologies and procedures? The research methodology and procedures for this research were specifically chosen to achieve the research objectives. The justification of choices will be presented in this chapter and the development of the survey questionnaire will be discussed.

This chapter consists of five sections. Section one discusses the research process. Section two elaborates on the research design employed in the study. Section three explains the design of the educator and the principal questionnaires. Section four describes how the questionnaire was administered and section five evaluates the factor structure of the items used for statistical analysis.

5.2 Section one – factors considered during the research process

5.2.1 The research process

The present research process followed the procedure of a hypothetico-deductive method, as suggested by Sekaran (2003, p.29). According to this method, scientific inquiry proceeds by formulating a testable hypothesis in a form that could be falsified by a test on the observable data. It was introduced by the English scholar, William Whewell (1794-1866), and popularised by the Australian philosopher, Karl Popper (1902-1994).

The hypothetico-deductive method (see Figure 5.1) consists of eight steps.

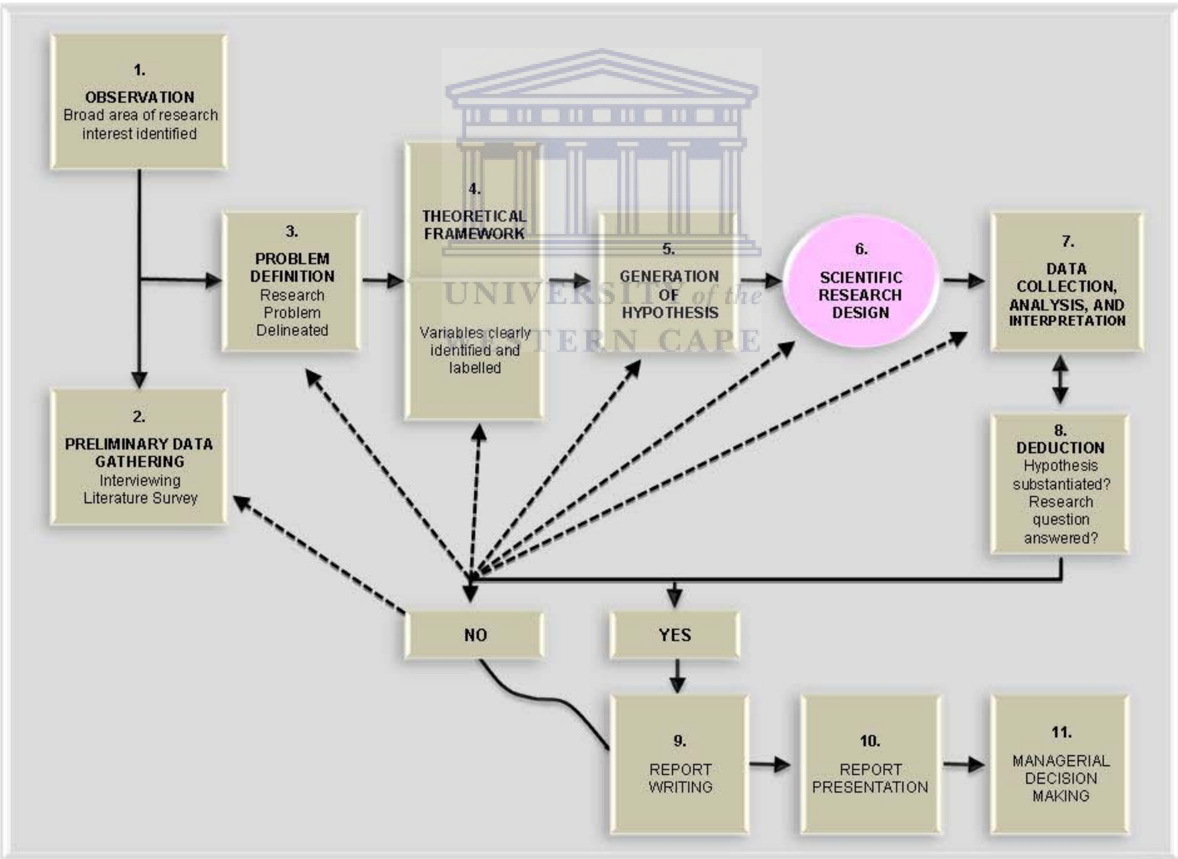

Figure 5.1: The research process (Sekaran, 2003, p.117)

A brief discussion on each of the eight steps employed in this study will now be given below.

5.2.1.1 Observation (step 1)

Observation was conducted in a few schools, while educators were conducting their daily classroom lessons. This information was used to supplement the data in Chapter 8.

5.2.1.2 Preliminary information gathering (step 2)

Preliminary information gathering was conducted by informally talking to several educators so that the researcher could get a ‘feeling’ for what was transpiring in the actual situation. At the same time a literature review was undertaken. This information was eventually used to assist the researcher during the design of the questionnaire.

5.2.1.3 Problem definition (step 3)

After the extensive literature review (see Chapters 3 and 4), the problem was narrowed down from its original broad base. The information gathered from the literature review guided the researcher regarding the variables used in the study as appropriate predictors for the use of computers in secondary schools.

5.2.1.4 Theory formulation (step 4)

Theory formulation includes all the important factors that contribute to the use of computers for teaching purposes in secondary schools. It is an “attempt to integrate all the information in a logical manner,” and is a compilation of theories, beliefs and models from the literature review in order to conceptualise and test the reasons for the problems (Sekaran, 2003, p.30).

5.2.1.5 Hypothesis (step 5)

Hypothesising “is the next logical step after theory formulation” (Sekaran, 2003, p.31). This step was used to generate the various hypotheses (see Chapter 4) to examine whether the theory formulated was valid or invalid.

5.2.1.6 Scientific research design (step 6)

Two questionnaires were adopted and then adapted from previously validated studies to collect data determining the use of computers in secondary schools (see Appendix A and B).

5.2.1.7 Data analysis (step 7)

In the data analysis step, data were statistically analysed to investigate which variables influenced the use of computers in secondary schools. A few statistical tests were carried out during this stage (see Chapter 6).

5.2.1.8 Deduction (step 8)

Deduction is the process after the data have been statistically analysed, where conclusions are drawn by interpreting the meaning of the results. This will be done in Chapters 6, 7 and 8.

5.3 Section two – factors considered during the research design

5.3.1 Research design

This study was conducted in four phases. Phase one - the main literature review was conducted from August 2007 to May 2009 but was continuously updated with new publications throughout the duration of the study. Phase two consisted of collecting information from school district managers and principals regarding the use of computers in schools which assisted in the development of the questions included in the main questionnaire. Information for phase two was collected during the period of December 2008 to June 2009.

During the third phase - June to October 2009 - data were intensively collected by means of questionnaires distributed in 53 secondary schools in the Western Cape central metropole. The fourth phase was the analysis and interpretation of the data that took place during the period from December 2009 to March 2010.

Neuman (2000, p.250) states that “survey research is often called correlational.” Following a rigorous evaluation of the various research methodologies, a survey-correlational study was found to be the most appropriate method for this research since this method is frequently used in research on information technology and computer use.

According to Babbie and Mouton (2001), a survey usually adopts both qualitative and quantitative methodologies. Here samples of subjects are extracted from a population and investigated to make inferences about the population. Accordingly, the survey research method is considered particularly useful for generating quantitative data that can be used to establish the basis for wider generalisation.

Moreover, it allows the researcher to collect data from a sizeable population, which is geographically dispersed - when “budget constraints prevent you from surveying the entire population” (Saunders *et al*., 2003, p.151).

A questionnaire is administered to obtain participants’ responses to the variables under investigation. The data collected on these variables can then be studied using the appropriate statistical procedures. The questionnaire administered in the current study was used to test the statistical relationships among the variables.

Research design involves a sequence of rational decision-making choices. Sekaran and Bougie (2010) postulate that research design is the step aimed at designing the research studies in such a way that data can be collected and interpreted to arrive at a solution. Using the guidelines, as suggested by Sekaran (2003), the following eight design steps (see Figure 5.2) were considered in this research project.

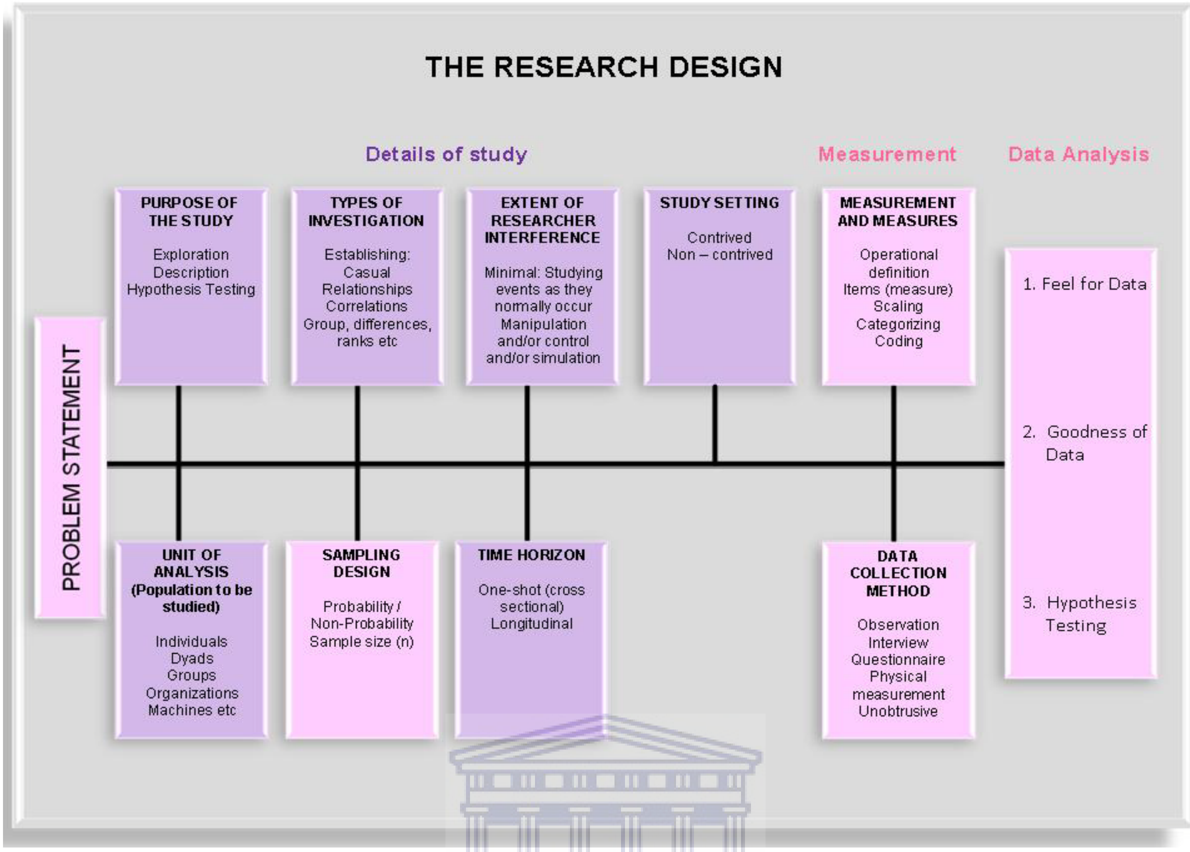

Figure 5.2: The research design (Sekaran, 2003, p.118)

5.3.1.1 Purpose of the study (step 1)

The purpose of this study was hypothesis testing. Sekaran (2003, p.119) states that studies "may be either exploratory in nature or descriptive, or may be conducted to test hypotheses." Furthermore, the scholar believes that studies relating to hypothesis testing explain the nature of certain relationships; they establish the differences among groups or the independence of two or more factors in a situation (Sekaran, 2003, p.124).

Hypothesis testing is undertaken in order to explain the variance in the dependent variable. In addition, hypothesis testing offers an understanding of the associations that exist among variables and could create 'cause-and-effect' relationships (Sekaran and Bougie, 2010; Saunders *et al*., 2003).

5.3.1.2 Type of investigation (step 2)

This is a survey-correlational study because the research is concerned with delineating the variables related to the problem instead of delineating the cause of one or more problems (Sekaran and Bougie, 2010). In addition, this research attempts to establish cause-and-effect relationships through certain types of correlational or regression analyses.

5.3.1.3 Extent of researcher interference with the study (step 3)

This study was conducted in the natural environment of the school. Accordingly, working in the natural environment minimises interferences made by the researcher with the normal flow of classroom activities, compared with those caused during causal studies.

5.3.1.4 Study setting (step 4)

As this study is termed 'survey-correlational' it was conducted in natural school settings, whereas rigorous causal studies are conducted in contrived laboratory settings (Sekaran, 2003). Organisational research can be done in the natural environment where duties are performed in their normal settings.

5.3.1.5 Unit of analysis (step 5)

The unit of analysis is the major entity that is to be analysed in the study. It is normally the 'what' or 'who' that is being studied. In this study, the unit of analysis is the individual educator in secondary schools of the Western Cape central metropole. Kervin (1992, cited in Hussey, J and Hussey, R 1997, p.122) states that it is best to select a unit of analysis at "as low a level as possible," as it is at that level that decisions are made.

The unit of analysis refers to the level of aggregation of the data collected during the subsequent data analysis stage. Therefore, each response will be treated as an individual data source.

5.3.1.6 Time horizon of the study (step 6)

A study can be either cross-sectional or longitudinal. According to Hussey, J and Hussey, R (1997, p.59), “Cross-sectional studies are a positivistic methodology designed to obtain information on variables in different contexts, but at the same time.” This study is regarded as a cross-sectional study because it aims to collect data only once over a period of a few months in order to realise the research objectives. In contrast, a “longitudinal study, is often, but not always, associated with a positivist methodology” (Hussey, J and Hussey, R 1997, p.62). A longitudinal study is a study over time where data on the dependent variable are collected more than once to answer the research question.

5.3.1.7 Data collection (step 7)

Data collection is the process of collecting data associated with variables in the hypotheses in order to test these hypotheses (Hussey, J and Hussey, R 1997).

5.4 Section three – factors considered in the questionnaire construction process

5.4.1 Survey methodology

Hussey, J and Hussey, R (1997, p.54) strongly believe that methodology “refers to the overall approach to the research process, from the theoretical underpinning to the collection and analysis of the data.” In addition, these scholars state that methodology may be associated with the following main issues (Hussey, J and Hussey, R 1997, p.54):

- Why one collects certain data;
- What data one collects;
- From where one collects them;
- When one collects them;
- How one collects them; and
- How the data were analysed.

Survey research is mostly quantitative in nature and seeks to provide an overview of the phenomenon being studied by using a sample. Primary data are collected by administering questionnaires that allow for statistical analysis. The data collected are analysed using descriptive and inferential statistics, focusing on factor analysis, correlations, comparison of means, and regression analysis (Field, 2005; Sekaran and Bougie 2010; Saunders *et al*., 2003).

The advantages of survey studies are that they can obtain a large amount of information from a large population. Survey studies can reach a large number of respondents to participate in the study. Flexibility is another advantage of survey studies. The study allows for the asking of questions on many variables simultaneously, thus saving on time (Sekaran and Bougie 2010; Saunders *et al*., 2003).

Sekaran and Bougie (2010) argue that survey studies also have some disadvantages. Completing a survey can only be done on a voluntary basis. Respondents do not always respond promptly or complete the survey instrument correctly. Therefore surveys need to be managed carefully to ensure a good response rate.

5.4.2 Methodology and methods

The methodology will be the general plan of how the researcher goes about answering the research questions. Hussey, J and Hussey, R (1997) aver that there are numerous methodologies such as experimental studies, longitudinal studies, surveys, action research, case studies and grounded theory.

The survey-correlational research methodology was considered a suitable methodology for this study. It is focused on selecting a sample of individuals from a population and then analysing this information using statistical techniques to make inferences about the population. When the population is large, as in the case of this study, Hussey, J and Hussey, R (1997) advise that only a sample of the whole population should be used.

Methodology is concerned with the overall approach to the study or the design behind the choice of certain methods. Based on the methodology selected, it is important to establish which methods should be used in this research.

Hussey, J and Hussey, R (1997, p.115) assert that methods are the various means and techniques for collecting data. The method chosen "also has implications for the choice of *research problem* and *research questions*".

In this study, the following four methods were used, namely:

(1) Literature search and review;

(2) Interviews of school district managers and school principals to collect preliminary information about the state of computers and their use by educators in schools;

(3) The questionnaire method, which is most commonly used in collecting primary data in surveys; and

(4) Statistical methods, such as regression analysis, factor analysis, descriptive statistics and ANOVA to analyse the data.

The data source for this study was primary information that was collected by a questionnaire survey. However, there were instances where secondary data had to be used such as educational policies, previous research and government statistics. Hussey, J and Hussey, R (1997, p.86) state that "secondary data is data which already exists," therefore there is no need for the researcher to collect such data.

Silverman (2000) draws attention to a useful table (see Table 5.1) which explains the concepts used in this research. The scholar believes that models provide a framework for highlighting what reality is and the basic elements it contains.

Table 5.1 Basic terms used in this research

Term	Meaning	Relevance
Model	An overall framework for looking at reality. (e.g. behaviourism, feminism)	Usefulness
Concept	An idea deriving from a given model.(e.g. ‘stimulus response’, ‘oppression’)	Usefulness
Theory	A set of concepts used to define and/or explain some phenomenon	Usefulness
Hypothesis	A testable proposition	Validity
Methodology	A general approach to studying research topics	Usefulness
Method	A specific research technique	Good fit with model, theory, hypothesis and methodology

Source: Revised version of Silverman (1993, p.1 in Silverman, 2000, p.77)

5.4.3 Preliminary information for developing the questionnaire

During the preliminary phase of the research, exploratory interviews were conducted to collect preliminary information, as suggested by Hussey, J and Hussey, R (1997). The interviews were conducted using a face-to-face interviewing technique with open-ended questions. School district managers, secondary school educators and school principals were targeted. Simple random sampling was used to select the individuals to be interviewed.

There are numerous ways of collecting information such as in-depth interviews, observation, digital recording and open-ended questions (Remenyi, Williams, Money and Swartz, 1998). Structured interviews are normally formalised, and have a limited set of questions, while semi-structured interviews are flexible and allow new questions to be considered during the interview resulting from what the respondent says. Researchers in semi-structured interviews generally have a framework of ideas that they intend to explore.

During this phase of data collection, it is appropriate to use the semi-structured interview method. This allows the researcher to use various techniques to collect data that could be analysed both quantitatively and qualitatively.

A digital recorder was used to collect data from the principal questionnaire, which was purely qualitative. The researcher allowed the participants to speak freely on various issues relating to educators' use of computers and was able to probe for further details.

The researcher had a list of questions which were extracted from the literature (see Appendix C) to act as a framework during the interview. The questions investigated the actual lesson delivery by educators via the use of computers in classes. Subsequently, a huge amount of information was collected through the interviews and literature review. This information combined with variables extracted from the literature review and previously validated questionnaires (see Appendix L) was used to develop the educator questionnaire.

The preliminary outline of questions of the subject being studied was juxtaposed against previously validated questionnaires found in the literature review and was then used to develop the general format of the questionnaires.

5.4.4 Questionnaire construction process

According to Sekaran and Bougie (2010), questionnaire design consists of a number of interrelated steps that start with the wording of the questions, how the variables will be categorised and the general appearance of the questionnaire (see Figure 5.3). The authors state that the principles of wording are about the appropriateness of the questions, the level of sophistication of the language and the sequencing of the questions. In addition, they state that the principles of measurement refer to the scales and scaling techniques that are used in the measuring concepts. Moreover, the data should be obtained for easy coding and categorisation.

In the figure, the general appearance or "Set-Up" refers to the appearance of the questionnaire. Sekaran and Bougie (2010) believe that a good introduction, organised instructions and the neat alignment of questions make the answering of the questionnaire much easier.

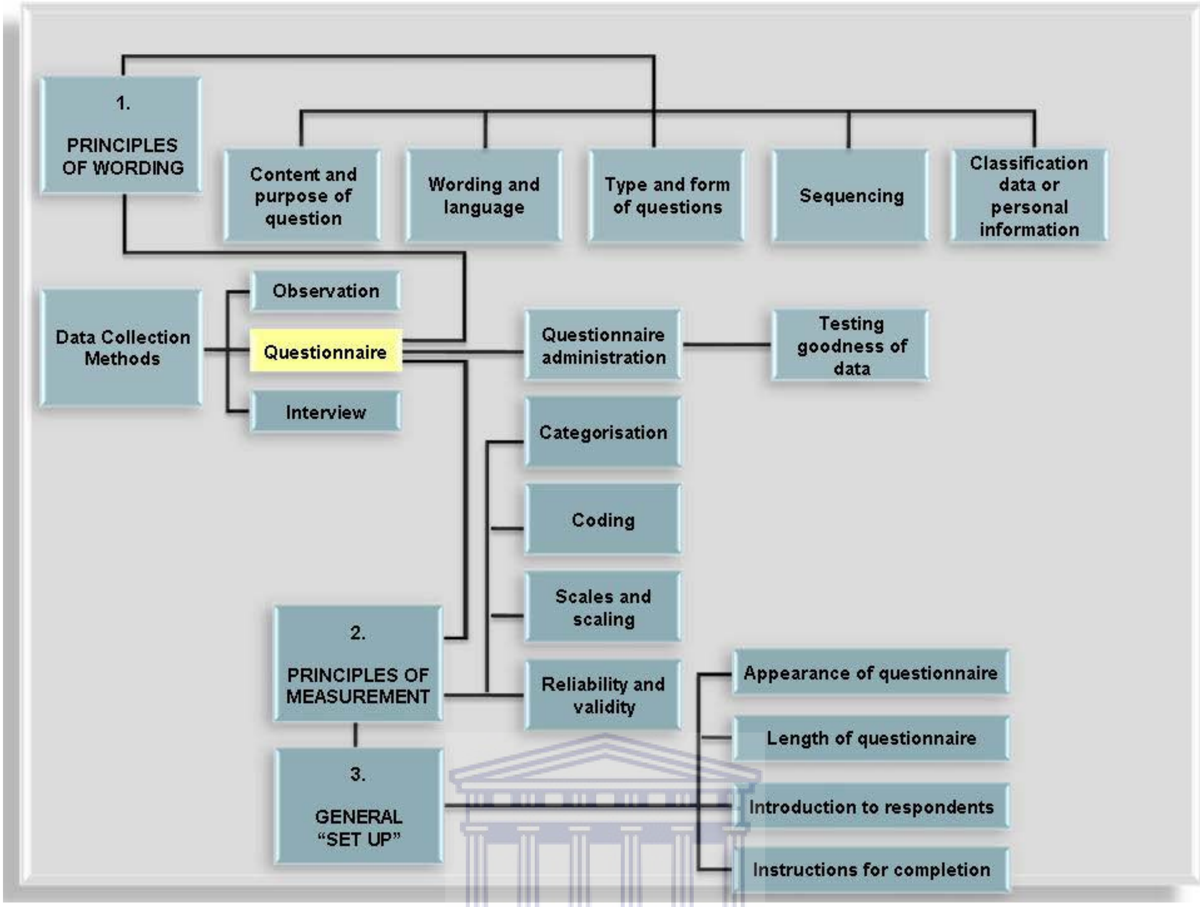

Figure 5.3 Principles of questionnaire design (Sekaran, 2003, p.238)

5.4.5 The questionnaire survey

When conducting questionnaire-based research, Remenyi and others (1998) state that there are three important interrelated activities that the researcher should consider. These erudite scholars believe that the design of the questionnaire, the administration of the instrument and the choice of the sample should be well planned.

A questionnaire is a pre-formulated written set of questions to which respondents record their answers. Furthermore, according to the type of study, the survey questionnaire seeks evidence on "opinions or beliefs related to behaviours, experiences, activities and attitudes" (Remenyi *et al.*, 1998, p.150). Reasons for using the questionnaire survey method in this research are:

- It is an efficient data-collection tool when the researcher knows what is required and knows how to measure the variables concerned;
- It allows for a large collection of data from a sizeable population in an economical way; and
- It is used because Saunders and others (2003) strongly believe that by using a survey questionnaire this provides the researcher with more control over the research process.

There are two methods whereby evidence can be collected, namely interviews and self-completion (Remenyi *et al.*, 1998). The latter method was used to collect data from educators, while the interviews were used to collect data from the principals in this study. During the literature study, the researcher observed that there were many occasions when studies reported a low rate of responses - especially when questionnaires were mailed to the individuals. Therefore, it could be expected that the return rate of mail questionnaires would typically be low because of past experiences with surveys conducted in South Africa.

With a low return rate it is difficult to establish the representativeness of the sample. Being mindful of poor responses, the researcher used considerable effort to improve the response rate. Instead of mailing the questionnaires to the various schools, the researcher personally hand-delivered and collected them from the principals and the secretaries of the respective schools who were part of the survey.

Personally administered questionnaires are a good way to collect data when the survey is limited to a local area.

5.4.6 Measurement scales

According to de Vaus (2007), variables may be classified as having a certain level or scale of measurement. Knowing the level or scale of measurement of a variable is important when statistical analyses are to be conducted. Many statistical techniques require that variables be measured according to a particular scale (de Vaus, 2007). A scale may be defined as any series of items that are arranged progressively according to varying degrees of sophistication (Sekaran and Bougie, 2010).

The choice of type of scale is crucial because the nature of the scale will determine whether the intended information can be collected and whether certain types of descriptive and inferential statistics can be executed. Table 5.2 presents the four basic types of scales with a brief explanation of when they should be used (Sekaran and Bougie, 2010).

Table 5.2 Basic data scales

Nominal	Ordinal	Interval	Ratio
People or objects with the same scale value are the same on some attribute.	People or objects with a higher scale value have more of some attribute.	Intervals between adjacent scale values are equal with respect to the attribute being measured.	There is a rational zero point for the scale.
The values of the scale have no 'numeric' meaning in the way that you usually think about numbers	The intervals between adjacent scale values are indeterminate.	Example: The difference between 8 and 9 is the same as the difference between 76 and 77.	Ratios are equivalent, e.g., the ratio of 2 to 1 is the same as the ratio of 8 to 4.
	Scale assignment is by the property of "greater than," "equal to," or "less than."		

5.4.6.1 Nominal scale

Sekaran and Bougie (2010) believe that the nominal scale is the simplest type of scale. It allows researchers to assign subjects to a particular category or group. In the case of the nominal scale, a number is assigned to identify the subject being considered, for example, assigning the numeral 1 for males and 2 for females.

Only percentages and the mode as examples of descriptive statistics can be calculated. The Chi-square and Binomial tests are examples of inferential statistics that can be calculated from the use of nominal scales. Therefore, the nominal scale provides some basic, categorical, and gross information.

5.4.6.2 Ordinal scale

Ordinal scales categorise variables in a way which denotes differences among the various categories. In addition it rank-orders the categories from low to high (de Vaus, 2007). Ordinal scales represent numbers, letters or other symbols used to rank items. They arrange objects or alternatives according to their magnitude in an ordered relationship - for example, to assign the numeral 1 for first preference and 2 for second preference.

However, one cannot specify numerically how much difference there is between the categories. For example if age includes the categories 'child', 'adolescent', 'young child', 'middle-aged' and elderly the data will be measured on the ordinal scale (de Vaus, 2007).

5.4.6.3 Interval scale

According to Sekaran and Bougie (2010), interval scales allow the researcher to perform certain mathematical calculations on the data collected from the respondents. Interval scales not only indicate order, but they also measure order (or distance) in units of equal intervals. Moreover, the scale has no absolute zero value.

5.4.6.4 Ratio scale

The ratio scale is regarded as being at the highest level of measurement, as it contains all the properties of the nominal, ordinal and interval scales (de Vaus, 2007). Ratio scales are the most powerful of the four scales because they have an absolute zero value, which is a meaningful measurement point. Therefore, the ratio scale not only measures the size of the differences between the points on a scale, but also measures the proportions in differences.

Table 5.3 shows the possible arithmetical calculations that may be performed by using the various scales.

Table 5.3 Permissible arithmetic operations

Nominal	Ordinal	Interval	Ratio
Counting	Greater than or less than operations	Addition and subtraction of scale values	Multiplication and division of scale values

For the purpose of this study, a combination of scales is used to solicit the required information for analysis purposes. The objective was to make use of more interval and ratio scales to facilitate more powerful tests and analysis. It is also important to note that multiple measures or scales are becoming more acceptable as researchers have moved away from using single scales to measure a variable (Hussey, J and Hussey, R 1997; Sekaran, 2003; Remenyi *et al*., 1998).

Based on the above discussions, some of the relevant suggestions will be used in the construction of the principal and educator questionnaires, which will now be discussed.

5.5 The educator and principal questionnaires

Two structured questionnaires, the Educator Questionnaire (EQ) and the Principal Questionnaire (PQ), were used as the research instruments in the present study (respectively Appendix A and B). According to de Vaus (2007), a questionnaire includes all techniques of data collection. In addition, this scholar avers that individuals are requested to respond to the same questions in a set order. Supporting de Vaus (2007), Hussey, J and Hussey, R (1997, p.161) state that there is a list of well-prepared questions “chosen after considerable testing” with a view to extracting reliable responses from a specific sample. In the designing of the questionnaires, concepts were derived from the theories and models in Chapter 2, as well as the theoretical framework and research hypotheses in Chapter 3 and Chapter 4.

Moreover, information from the literature review was used to identify the variables found to influence the use of computers in classrooms. Items adopted or adapted for use were those that had shown high degrees of internal consistency in their particular studies. This ensured the reliability of the questionnaire (see Appendix A and B).

A covering letter (see Appendix D) was attached to the questionnaire to explain the survey objectives to respondents. To establish credentials and legitimacy the covering letter explained that the study was to be used to collect data for a PhD degree. The letter also indicated that all information obtained would be subject to anonymity and confidentiality and would be used only for the purposes of the present study.

5.5.1 The educator questionnaire

The questionnaire was categorised into seven different sections (see Table 5.4). Each of the sections was aimed at obtaining responses in accordance with the main objectives of the study. The final questionnaire is appended as Appendix A.

Table 5.4 Main sections of the educator questionnaire

No	Heading	Information requested	Items
1	Personal information	Name; age; gender; degree; teaching experience; and computer experience.	5
2	General information	Level of computer use; instructional methods used. Competence levels and how knowledgeable educators are to do various computer activities.	29
3	Educator theories and beliefs	Educational purposes; approaches and management; value of using computers; changes in practice with computers; influences in using computers; whether lessons are more interesting by using computers; and development of student's learning skills.	22

No	Heading	Information requested	Items
4	Access to computers	Access and internet use at school; easy access to computers by location; obstacles affecting access to computers; computer hardware; and software problems.	13
5	Educator attitudes towards computers	Levels of agreement or disagreement in using computers; ease at using computers in class; computer-phobia; suitability in using computers for teaching and learning; how educators are using computers; views and opinions about computers as a valuable tool for lesson delivery in classes; and the views of educators in using computers to teach.	18
6	Educator support in using computers	Type of support received; availability of technical support; support regarding the integration of computers into the curriculum; collegial support in using computers;	10
7	Training	Number and types of courses attended; value of in-service training; training on new educational software; training on general administrative programs; and general computer skills.	24
8	Educator pedagogy	Reasons for using the internet; preference in using computers to deliver lessons; if computers assist the learning process; using computers increases or decreases workloads; and the extent to which educators are using computers for teaching and learning.	21
		Total number of questions	**142**

5.5.2 The principal questionnaire

According to Fullan (2001, p.150), the role of the principal has become more intimidating, more “complex and important to those who learn to lead change, and are supported in that role”. The literature review has highlighted how important the leadership and supporting roles of the principals are in the implementation of computer innovations in schools. Furthermore, it should be noted that “school improvement is an organizational phenomenon and therefore the principal, as leader, is the key for better or for worse” (Fullan, 2001, p.146).

The Principal Questionnaire (PQ) was developed (see Table 5.5) to gather data in support of what educators receive in using computers for their lesson delivery, the type of resources in the schools, barriers in the implementation of computer innovations in schools, the funding of computers, and in-service and pre-service educators’ training and attitudes towards using computers.

The final principal questionnaire, which is a qualitative questionnaire, is appended as Appendix B.

Table 5.5 Main sections of the principal questionnaire

No	Heading	Information requested	Item
1	Personal information	Name; age; gender; degrees; and school details	5
2	General information	School characteristics; staff complement; the school’s computer experience; access to the internet; ICT policy and budget for computers.	2
3	Use of computers	Personal use of computers; purpose and frequency of use; anecdotal evidence on the implementation of computer innovations; and the difficulties that educators are experiencing	1

No	Heading	Information requested	Item
4	Computer resources	Amount of computer resources for teaching and administrative use; where computers are situated; and what type of software is being used for teaching.	1
5	Staff and computers	Number of educators who have attended in-service training; support for educators, educator professional development; amount of educators actually using computers during lesson delivery; educator collegial support; and internal or external support, barriers to the use of computer in class rooms.	3
6	Educational computer projects	The school's involvement in the various government and other donor agencies regarding educational computer innovations or projects, amount of time dedicated to the projects.	1
		Total number of questions	**13**

5.6 Relationship of research questions to the survey questionnaire

Table 5.6 below indicates which items in the questionnaire were used to address the seven research questions.

Table 5.6 Questions used to address the research questions

Question number	The research questions	Addressed by survey questions
1	Do educators' beliefs have any impact on computer usage?	4.1 – 4.22
2	Do secondary school educators have the necessary access to computers?	5.1 – 6.7
3	What is the impact of educators' attitudes on using computers for teaching purposes?	7.1 – 7.18
4	What support do the educators receive in using computers for teaching purposes?	8.1 – 8.10
5	Does training make any difference in the level of computer use by educators?	11.1 – 13.6
6	Which educator pedagogical factors determine the use or non-use of computers for teaching purposes?	14.1 – 16.5
7	Computer utilisation for teaching purposes	17.1 – 17.18

5.7 The pilot study

It is often necessary to review the data-collection method once the pilot questionnaire has been designed. The pilot questionnaire must be pre-tested and changes must be made where necessary. After pre-testing and improvement of the questionnaire, so that respondents would not find any problems when answering the questions, it is then ready for the final data collection. Conducting a pilot study minimises the risk of capturing incorrect data, as well as detecting weaknesses in the design and measuring instrument. In addition, the pilot study should draw subjects from the target population and simulate the procedures and protocols designed for data collection (Hussey, J and Hussey, R 1997; Saunders *et al.*, 2003; Sekaran, 2003).

The purpose of pilot surveys is according to Bell (1999, cited in Saunders *et al.*, 2003, p.309) to determine:

- How long the questionnaire took to complete;
- The clarity of the instructions;
- Which, if any, questions are unclear or ambiguous;
- Which, if any, questions the respondent was uneasy about answering;
- Whether, in their opinion, there were any major topic omissions;
- Whether the layout was clear and attractive; and
- Whether there were any other comments?

The pilot survey was conducted by a personal visit to a secondary school where the educators were not connected to the sample group proper. The school secretary was requested to distribute the questionnaire to the respondents with a short explanation of the survey. In addition, a contact number from each respondent was requested as a follow-up to the survey. In total, 47 questionnaires were distributed. The time taken to answer all the questions in the pilot survey was between 15 and 20 minutes.

After two days, a follow-up was done, and the response rate was 20%. This was insufficient to perform any meaningful corrections to the questionnaires. After two weeks of follow-up, 35 out of the 47 questionnaires, which had been administered, were completed. This amounted to a response rate of 75%. Each of the completed pilot questionnaires was individually scrutinised, as suggested by Saunders and others (2003).

The scrutinising of the pilot questionnaire procedure was done to determine whether any of the respondents had difficulties in interpreting or answering the questions – whether the instructions were clearly understood, and to take note of any criticisms and comments made by the respondents. A few changes were made to the questionnaire design, such as the formatting of the questionnaire in order to improve the understanding. Changes were made to negatively worded items and the respondents' feedback was acknowledged. Items included changes to the wording of the covering letter to make it read in a more submissive manner. Based on the above observations minor changes were made to the wording and layout to question 4.3 and question 5.6.

5.8 Reliability of the questionnaire

According to Sekaran and Bougie (2010), reliability is the consistency in obtaining the same result when measurements are repeated over and over again. In other words, reliability should be a measurement of instrument accuracy in determining whether any differences have arisen out of confusion. The pre-testing of the questionnaire and the fact that the questions in the questionnaire were from previously validated research, increases the reliability of the questionnaire.

Special care was taken to re-test the questionnaire where items had been re-worded or changed. One method to test for reliability is to administer the questionnaire at two different points in time to determine whether there are any significant differences. A reliability test of this nature is inappropriate in the present study, as it is a once-off study and not a longitudinal study.

Another method to test for reliability is to the address the issue of internal reliability. This is normally done to measure how well a group of questions correlates with a concept or construct (Hussey, J and Hussey, R 1997; Sekaran, 2003; de Vaus, 2007).

Cronbach's alpha was used to test for inter-item consistency. According to de Vaus (2007, p. 21), "…of the internal consistency measures Cronbach's alpha is the most widely used and is the most suitable". This scholar maintains that it examines how a group of variables is related to other groups of variables. According to de Vaus (2007), reliabilities in the 0.8 range is good and those in the 0.7 range is still acceptable. The closer the reliability coefficient gets to 1.0, the better. Reliability tests for each of the dimensions will be discussed under data analysis later in this chapter.

5.8.1 Validity of questionnaire

According to Hussey, J and Hussey, R (1997), validity is the extent to which the findings of the research truthfully represent the phenomenon being studied. Sekaran and Bougie (2010) strongly advise that researchers should be sure that they are measuring the concept they set out to measure and not something else.

Sekaran (2003) states that there are many validity tests that can be used to test the validity of the measures, such as content validity and criterion-related validity.

5.8.2 Content validity

Content validity involves examining the extent to which the measure assesses the various aspects of the concept through ratings by expert judges or other means (de Vaus, 2007; Sekaran, 2003). Content validity is an assessment made by experts in that particular field of study to determine whether the questionnaire includes all the relevant questions and that nothing important has been excluded to meet the purpose of the study. On the other hand, face validity is a basic index of content validity, which indicates items that "do on the face of it look like they measure the concept" (Sekaran, 2003, p. 206). This study used both content and face validity by asking a few school principals (excluded from the study) to provide their opinions and criticisms of the questionnaire.

Based on their suggestions and recommendations some changes were made to the wording and the layout of some of the questions.

5.8.3 Criterion validity

Criterion validity is the ability of the questionnaire to predict some future event or behaviour. Neuman (2000) believes that criterion validity uses a certain standard, for example, responses from a well-established measure to indicate a construct accurately. Criterion validity was not used because of the danger of a low correlation between the "new and the established" questionnaires (de Vaus, 2007, p.28). Moreover, the author believes that the low correlation could be attributed to problems with the established questionnaires used in previous studies.

5.8.4 Scale reliability

According to Sekaran and Bougie (2010), the choice of scales has an influence on scale reliability. Moreover, they state that this should be evenly balanced. Nunnally (1978, p. 521) states:

As the number of scale steps is increased from 2 up through 20, the increase in reliability is very rapid at first. It tends to level off at about 7, and after about 11 steps, there is little gain in reliability from increasing the number of steps.

Following the advice of Sekaran and Bougie (2010) and Nunnally (1978), the questionnaire was limited to five-point scales.

5.9 Population and sample

5.9.1 Population

The population of this research is the body of people that the researcher wishes to investigate (Hussey, J and Hussey, R 1997) and incorporates the educators and principals who are teaching in secondary schools in the Western Cape central metropole. There are 1816 (n=1816) secondary school educators and 60 (n=60) principals teaching in 60 schools in the Western Cape central metropole (WCED, 2009). The research did not include secondary school educators and principals in the Western Cape, North, South and East educational metropoles, due to lack of funding, time, logistics and travelling constraints.

5.9.2 Sample

Saunders and others (2003) aver that sampling techniques provide a range of methods, which enable the researcher to reduce the amount of data collected and to determine the representativeness of the sample for generalisability. Moreover, Sekaran (2003, p. 266) believes that “a sample is a subset of the population” and consists of a few subjects selected from it. Hence, by studying the sample researchers should be able to reach conclusions that would be generalisable to the population.

This study made use of a convenience sampling technique (Sekaran and Bougie, 2010). In this study the population was 1816 (n=1816) secondary school educators as mentioned in 5.9.1. In some studies the entire population is surveyed, providing it is of a manageable size. All (n=60) principals were selected for the sample.

Therefore, the original intention was to survey all the educators in the Western Cape central metropole. However, due to the unwillingness of administrators at seven schools, no educators from those schools could be included in the study. Amongst educators from the remaining 53 schools, only 812 out of approximately 1528 responded, to give an overall response rate of 53%. The 812 respondents might be considered a convenience sample from the Western Cape central metropole.

The initial intention was not to take a 'convenience sample', although, the outcome of the process functionally resulted in this option.

5.10 Section four – data collection

5.10.1 Questionnaire administration

The study was conducted in 60 secondary schools in the Western Cape central metropole within a period of three months from 1 July 2009 to 30 September 2009, because the Western Cape Education Department did not allow any surveys to be conducted during the fourth school term (i.e. October 2009 - December 2009), due to school examinations.

There were serious concerns about the response rate, as there is generally a very low response rate in many surveys in South Africa. The researcher telephoned the secretaries of all 60 schools informing them to expect a fax on the purpose of the researcher's visit to their school regarding the survey.

The fax contained two letters.

The first letter (see Appendix D) informed the principal about the nature of the research and the second letter was from the Western Cape Education Department, granting permission for the research to be conducted in that particular school (see Appendix H).

In addition, the fax and e-mail details of the school were telephonically verified. After the first batch of faxes had been transmitted, it was evident that some schools had problems with their fax machines.

Some of the reasons found were: insufficient fax paper or the fax machine was unplugged; hence, the letters were re-faxed a second time.

Two days later the researcher drove to all 60 schools over a ten-day period to personally hand-deliver the questionnaires to the principals in order to avoid a low response rate. In many instances, the researcher was requested to deal with the school secretary or with the deputy principal.

After identifying the relevant staff members, the researcher requested that the secretary complete a control form with the school stamp for questionnaire follow-ups (see Appendix E). While at the school, the researcher enquired whether the principal was available for a short interview of 15 minutes.

Thirty-five principals agreed to be interviewed by the researcher. The principal questionnaire is appended as Appendix B.

In order to receive a good response, the researcher made 500 telephone calls to all 60 schools enquiring whether the educators had completed the questionnaire. Three school secretaries had mislaid the batch of questionnaires given to them, and thus the questionnaires were hand-delivered to these schools a second time.

Two school secretaries complained that only three out of their 35 educators (8%) had completed the questionnaire. With permission from the principal, the researcher personally visited these three schools and spoke to educators about the importance of the survey.

This may have helped in receiving a better response rate, but it did not help much, because most of the educators complained about their workloads.

Even with many telephone calls to follow up on the status of the survey, the response rate was still not as high as in other schools.

No research was allowed during the fourth quarter (i.e. October 2009 to December 2009) of the school year due to examinations. The researcher thus had to ensure that all questionnaires had been collected before 1 October 2009.

5.10.2 Response rate

Three trips were made to all the schools in the sample. Seven schools rejected outright the invitation to be part of the survey. This amounted to 288 educators (16%) out of the (n=1816) secondary school educators in the Western Cape central metropole who did not participate in the survey. No questionnaires were delivered to these seven schools. The researcher collected 820 questionnaires from 53 schools in the Western Cape central metropole. Eight questionnaires were considered unusable since they were incomplete and were subsequently excluded from the sample. Therefore, only 812 valid responses were used in the analysis of the data.

Table 5.7 presents the details of the data collection figures from all the schools in the survey.

Table 5.7 Questionnaire responses

No	School Name	Accepted Rejected	Amt of educators in school	Amt responded	%
1	School 1	Accepted	37	22	59.5
2	School 2	Accepted	27	13	48.1
3	School 3	Accepted	25	15	60.0
4	School 4	Accepted	16	4	25.0
5	School 5	Accepted	30	13	43.3
6	School 6	Accepted	23	6	26.1
7	School 7	Accepted	24	10	41.7
8	School 8	Accepted	18	8	44.4
9	School 9	Accepted	35	23	65.7
10	School 10	Accepted	27	18	66.7
11	School 11	Accepted	19	10	52.6
12	School 12	Accepted	33	6	18.2
13	School 13	Rejected	0	0	0.0
14	School 14	Accepted	21	9	42.9
15	School 15	Accepted	28	26	92.9
16	School 16	Accepted	19	11	57.9
17	School 17	Accepted	32	14	43.8
18	School 18	Accepted	30	26	86.7
19	School 19	Accepted	26	14	53.8
20	School 20	Accepted	41	15	36.6
21	School 21	Accepted	17	16	94.1
22	School 22	Accepted	36	15	41.7
23	School 23	Accepted	33	8	24.2
24	School 24	Accepted	37	25	67.6
25	School 25	Accepted	38	28	73.7
26	School 26	Accepted	33	21	63.6

No	School Name	Accepted / Rejected	Amt of educators in school	Amt responded	%
27	School 27	Accepted	42	29	69.0
28	School 28	Accepted	45	14	31.1
29	School 29	Accepted	23	15	65.2
30	School 30	Accepted	35	8	22.9
31	School 31	Rejected	0	0	0.0
32	School 32	Accepted	33	12	36.4
33	School 33	Accepted	31	9	29.0
34	School 34	Accepted	40	17	42.5
35	School 35	Accepted	26	14	53.8
36	School 36	Accepted	19	13	68.4
37	School 37	Accepted	30	15	50.0
38	School 38	Rejected	0	0	0.0
39	School 39	Accepted	20	6	30.0
40	School 40	Accepted	25	19	76.0
41	School 41	Rejected	0	0	0.0
42	School 42	Accepted	19	13	68.4
43	School 43	Accepted	36	12	33.3
44	School 44	Rejected	0	0	0.0
45	School 45	Accepted	46	37	80.4
46	School 46	Accepted	37	13	35.1
47	School 47	Accepted	47	24	51.1
48	School 48	Accepted	21	13	61.9
49	School 49	Rejected	0	0	0.0
50	School 50	Accepted	19	13	68.4
51	School 51	Accepted	28	9	32.1
52	School 52	Accepted	28	14	50.0
53	School 53	Accepted	34	9	26.5
54	School 54	Accepted	23	15	65.2
55	School 55	Accepted	15	12	80.0
56	School 56	Accepted	17	13	76.5
57	School 57	Accepted	51	39	76.5
58	School 58	Accepted	21	17	80.9
59	School 59	Rejected	0	0	0.0
60	School 60	Accepted	12	12	100.0
	Totals		**1528**	**812**	**53.0**

5.10.3 Summary of the responses

The result for the educator questionnaire was 812 usable responses out of 1528 that were administered, making this a 53% response rate. It should be noted that if the intense follow-up procedures in the collection of the questionnaires had not taken place, the response rate would have been reduced to about 25%.

Interestingly, it was noted that educators who were teaching in schools in more affluent suburbs tended to record a higher response rate. This may be because of these schools being better staffed, and having more computer resources than schools in less-privileged areas.

From the 53 principal questionnaires that were administered, only 35 principals completed the questionnaire resulting in a response rate of 66%.

Where permission was granted, some of the interviews were digitally recorded. The remaining 18 principals who refused to complete their questionnaires and refused the interview, cited reasons such as being too busy with other important administrative tasks, meetings with district managers and cluster meetings off the school premises. In addition, they argued that there was too much research being conducted in their schools.

5.10.4 Data editing

After the data-collection stage, each questionnaire was checked for errors, legibility and consistency in order to ensure completeness and the readability of the data. Thereafter, the data were captured into SPSS software version 17.0 for Windows. To ensure that the data were accurately captured "frequency distribution" in SPSS was run. A few errors were encountered; therefore screening and cleaning of the data had to be undertaken before any further analysis of the data could take place.

These errors were attributed mainly to human typing errors, because the questionnaire contained ten pages and the sample size was relatively large. Descriptive statistics were used in SPSS to screen each question to see if the value was out of range for each particular question. Errors made during the coding or data capture were found; and it was easy to verify the data before rectifying the error in the data set, because each questionnaire had a unique control number.

Descriptive statistics in SPSS were computed again to ensure complete accuracy of the data.

5.11 Data analysis and techniques

The data analysis methods employed in this study are both quantitative and qualitative. The qualitative analysis will be discussed in Chapter 7. After editing, screening and cleaning of the survey results, the database file was incorporated into SPSS.

The researcher began analysing the data by computing the basic descriptive statistics for all items on the questionnaire. According to de Vaus (2007), the researcher could then summarise patterns in the responses from the sample by using frequency tables, means, standard deviations and measures of skewness.

Before describing the characteristics of the sample (i.e. mean, standard deviation and skewness), it is advisable to determine the quality of the measuring instrument to be used.

To investigate this quality, two procedures can be used, namely: Exploratory Factor Analysis and Reliability Analysis. According to (Field, 2005), Exploratory Factor Analysis provides an indication as to the number of possible dimensions underlying the variable (i.e. latent construct).

To calculate how many dimensions need to be evaluated, Parallel Analysis can be used. Once the possible dimensions underlying each variable have been determined, it is important to determine the reliability of each dimension and variable. To determine the latter, Cronbach's coefficient alpha can be used.

After conducting both Exploratory Factor Analysis and Reliability Analysis, the study can continue reporting both descriptive and inferential statistical results, without any fear of the impact of poorly measured constructs.

The following section provides a brief discussion on the model statistics that were used.

5.11.1 Correlation (Bivariate *r*)

A statistical technique that can be used to determine the strength between two variables is Pearson's product-moment correlation coefficient (also known as Pearson's *r*). Pearson's *r* is used to provide the degree to which two variables covary. This correlation coefficient provides two important aspects of the strength between two variables. Firstly, the correlation coefficient provides an indication of the direction of the found relationship. Secondly, the correlation coefficient provides an indication of the strength of the association between the two variables. Therefore, correlation is used to measure the size and direction of the linear relationship between the two variables (Sekaran and Bougie 2010; Field 2005; de Vaus 2007; Saunders *et al.*, 2003). To determine the strength of these relationships, Guilford's informal interpretations of *r* can be used. These interpretations are discussed in the following section.

5.11.2 Magnitude of *r*

To evaluate the strength of a statistically significant relationship, it is important to have a guide to interpret the strength of the identified correlation. Guilford (cited in Tredoux *et al*., 2002) provides a reference on how to interpret statistical significant relationships among variables. Although a correlation may be statistically significant, it must be evaluated in the context of its associated strength and value to the research. This guideline indicates the effect size associated with a significant difference between the two groups' differences. Guilford's informal interpretations of the magnitude of *r* are presented in Table 5.8 below.

Table 5.8 Guilford's informal interpretations of the magnitude of r

Value of *r* (+ or -)	Informal interpretation
< 0.2	Slight; almost no relationship
0.2 – 0.4	Low correlation; definite but small relationship
0.4 – 0.7	Moderate correlation; substantial relationship
0.7 – 0.9	High correlation; strong relationship
0.9 – 1.0	Very high correlation; very dependable relationship

5.11.3 Multiple regression (Multiple *R*)

The idea of Multiple Regression Analysis is to use more than one independent variable to explain the variance in the dependent variable. This technique can identify the relative contribution of each of the independent variables in the prediction of the dependent variable. There are two techniques, namely: standard multiple regressions and stepwise multiple regressions (Field, 2005).

Stepwise multiple regressions are used for this study. Standard multiple regressions include all independent variables simultaneously into the multiple regression equation and determine each independent variable's contribution to the prediction of the dependent variable.

Stepwise multiple regressions exclude variables that are not significant to the model. In the end, the final model only presents items that are significant predictors. In addition, multicolinearity was considered when including the independent variables (Sekaran and Bougie 2010; Field, 2005; Tredoux *et al.*, 2002). Multicolinearity is a situation in which two or more variables are closely related.

During the interpretation of the multiple regression analysis, the following key indicators are focused on, as indicated in the model summary. Firstly, r^2 provides a measure of how much of the variance in the dependent variable can be accounted for by the independent variables. Secondly, the adjusted r^2 is an indication of how well the model generalises. Ideally, the adjusted r^2 must be very close to *R* (Field, 2005; de Vaus, 2007).

Both these measures are found in the model summary section and discussed for each multiple regression in Chapter 6.

5.11.4 Model parameters

The discussion above provides an indication of how well the model predicts the dependent variable using the independent variables. If an independent variable makes a significant contribution to the prediction of the dependent variable, then it must be determined what the standardised *ß* associated with each is (Field, 2005).

The standardised *ß* value provides information on how much the dependent variable will change if the relevant independent variable also changes.

The standardised *ß* value thus provides an indication of how important the specific independent variable is in the given model (Field, 2005; Tredoux *et al.*, 2002). Furthermore, it is important to determine the significance of group differences in this study. The difference between groups is discussed in the following section.

5.11.5 Comparing two groups using the *t*-test

According to de Vaus (2007), the most appropriate statistical technique to use when comparing two means with one another is the *t*-test. When two different groups are being compared, an independent *t*-test is used. The independent *t*-test is another technique that is used in this study.

The *t*-statistic together with the degrees of freedom associated with the comparison is used to determine if the two groups differ significantly from each other. By comparing the means of the two groups, it is possible to determine whether or not they differ significantly from each other (Field, 2005; Tredoux *et al.*, 2002).

One of the secondary objectives of this study is to determine the underlying structure associated with each of the independent variables. During the review of the measuring instrument used for the present study, it was evident that some of the constructs consisted of more than one factor, while others consisted of single factors only.

The next section provides a brief discussion on Factor Analysis.

5.12 Section five - evaluating the factor structure of the measuring instrument

5.12.1 Introduction to factor analysis

Factor analysis can be explained as a collection of statistical methods for reducing correlational data into a smaller number of factors (Field, 2005), for example, all the questions tapping several variables of pedagogy confidence in the educator questionnaire used in this study.

Therefore, before continuing with the analyses regarding the relationships among the variables, it is important to determine the factor structures to be used to provide a reliable and valid representation of the responses of the sample used.

Factor analysis is used to summarise the relationships in the form of identifiable and understandable factors that can be used in subsequent analyses.

The next section provides a brief discussion of two major approaches to factor analysis used in this study: exploratory factor analysis (EFA) and confirmatory factor analysis (CFA).

5.12.2 Exploratory Factor Analysis (EFA)

Exploratory Factor Analysis (EFA) is used when there are no specific expectations regarding the number and nature of the underlying factors in each of the independent variables. According to Field (2005), exploratory factor analysis is a technique that is used to reduce data to smaller sets of variables and to explore the underlining theoretical structure of the phenomena. Byrne (2005) concurs that EFA when properly used provides links between the observed variables and their underlying factors – even though these may be unknown.

This erudite scholar argues that EFA is merely exploratory, implying that the researcher has no prior knowledge that the observed variables do measure the intended factors. Effectively, the researcher uses Exploratory Factor Analysis to determine the factor structure.

5.12.2.1 ANOVA

ANOVA provides an indication of whether the model is a statistically significant fit with the data used for the multiple regression analysis (Sekaran and Bougie, 2010). In the ANOVA model, p values of less than 0.05 ($p<0.05$) indicate statistically significant differences between the sub-groups. Analysis of variance assumes that the variance of scores is the same in all groups. A post hoc comparison test was used to test for homogeneity of the variances.

P values of less than 0.05 indicate that there are significant differences between the variances.

The following steps, suggested by Field (2005), were used in this study to conduct exploratory factor analysis: (a) Determining how many factors can be extracted; (b) deciding which method of extraction should be used to extract the factors; (c) identifying the most appropriate method of rotating the factors; and (d) determining how factor scores must be computed if the factor scores are of interest.

5.12.2.2 Rotation

The pattern matrix produced by the oblique rotation assists in identifying an understandable and interpretable factor structure associated with each of the variables in this study. The goal of the rotation was to simplify and clarify the data structure (Field, 2005).

The following sections provide an explanation of whether the identified variables are factor analysable, as well as the reasons for the techniques that are used.

5.12.2.3 Deciding on the number of factors (Parallel Analysis & Eigenvalues)

Parallel analysis can be considered as one of the most-promising methods to determine the number of principal components or factors to retain. In parallel analysis, the focus is on the number of factors that account for more variance than the factors derived from random data. Problems may arise when non-optimal numbers of factors are extracted (O'Connor, 2005).

Under-extraction reduces variables into a small factor space, resulting in a loss of vital information. Over-extraction spreads the variables across a large factor space, resulting in factor splitting (O'Connor, 2005). The scholar argues that users simply trust the default-decision rule implemented in their statistical software packages (typically the eigenvalues greater-than-one rule). In addition, he believes that some users examine scree plots of eigenvalues, which are available in statistical packages, such as SPSS and SAS, before making their decisions.

O’Connor (2005) is of the view that these two highly popular decision rules are problematic. According to Zwick and Velicer (1986), the eigenvalues greater-than-one rule typically overestimates, and sometimes underestimates, the number of factors.

Cattell and Vogelmann (1977) believe that the scree test has been a strongly promoted alternative rule-of-thumb; however, it involves subjective (eyeball) searches of plots for sharp demarcations between the eigenvalues for major and minor factors. In practice, such demarcations do not always exist, or there may be more than one demarcation point. It is not surprising that the reliability of scree plot interpretations is considered low among experts (Crawford and Koopman, 1979; Streiner, 1998).

However, there is consensus among statisticians that the Parallel Analysis test is superior to other procedures and typically yields optimal solutions to the number- of-factors problem (Wood, Tataryn, Gorsuch, 1996; Zwick and Velicer, 1986).

The parallel analysis procedure is statistically based, rather than being a mechanical rule-of-thumb. The procedure used in this study for deciding on the number of factors involves extracting eigenvalues from random data sets that parallel the actual data set with regard to the number of cases and variables. The eigenvalues derived from the actual data are then compared with the eigenvalues derived from the random data.

The results from this test then provide the researcher with an indication of the number of factors that should be used in the study.

5.12.2.4 Determining factor scores

For this study, items that have a factor loading of below 0.30 are to be excluded from the factor structures of the variables (Hair, Black, Babin, Anderson and Tatham, 2006). These items were deleted because they had no significant factor loadings. Furthermore, this section describes the steps employed in the purification of the data collected to ensure that the statistics conducted would be accurate.

Each of the dimensions was analysed and tested for uni-dimensional or multi-dimensional factors.

Parallel analysis was conducted when required through the EFA results. Confirmatory Factor Analysis was used as a tool to compare the variables as to which variable provided a better fit.

The reason why two or three dimensions were chosen was based on the results from the Parallel Analysis Test. To evaluate the quality of the independent variable measurements regarding the data obtained, Confirmatory Factor Analysis (CFA) was conducted.

The next section briefly explains the variables and matrices used in conducting Confirmatory Factor Analysis. A brief overview of the various goodness-of-fit statistics that can be used to evaluate the validity of the measurement models of some variables in the present study and the use of item parcels in measurement models will now be discussed.

5.12.3 Confirmatory Factor Analysis (CFA)

Confirmatory Factor Analysis focuses on a measurement model (Field, 2005). In this research, Confirmatory Factor Analysis (CFA) was used for the following reasons: (a) To determine the number of factors that must be used; (b) which items reflect the identified factors; and (c) whether these factors are correlated. The difference between confirmatory factor analysis and exploratory factor analysis is that in CFA all factors affect the measured items.

5.12.3.1 Deciding on whether the data are factor analysable

This is done by calculating the Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy. As a guideline, this statistic should be higher than 0.6 (Field, 2005). Bartlett's test of sphericity is used to test whether group variances are the same - and the result should be significant (i.e. < 0.05). In addition, the Principal Axis method of extraction is used in this study.

5.12.3.2 Goodness of fit statistics

There are many goodness-of-fit statistics that can be used to determine the validity of the measurement models. In this study, the following goodness-of-fit statistics are discussed. Chi-square S-B (χ^2), *df* (Degrees of Freedom) ratio, Standardised Root Mean Square Residual (SRMR), Root Mean Square Error of Approximation (RMSEA), Normed Fit Index (NFI), Item parcelling and Comparative Fit Index (CFI). Each of these fit statistics will be briefly discussed below.

5.12.3.3 Chi-square (χ^2)

The most basic goodness-of-fit statistic is the Satorra-Bentler Scaled Chi-Square. This measure of fit determines and provides a statistical test for the difference between the two co-variance matrices ($S - \Sigma_k$). The χ^2 tests the null hypothesis when the discrepancy between S and Σ_k is zero and the hypothesised model is true (Marsh, Hau, and Weng, 2004).

5.12.3.4 Standardised Root Mean Square Residual (SRMR)

When comparing the observed co-variance matrix with the estimated co-variance matrix the resulting difference between each co-variance term is known as a residual. The standardised root mean residual (SRMR) is an alternative fit index that can be used to compare different models with each other (Hair *et al.,* 2006).

SRMR is known as the badness-of-fit measure, with higher values being an indication of a poor model fit. According Hair and others (2006), a random cut-off of between 0.05 and 0.08 can be suggested for SRMR.

5.12.3.5 Root Mean Square Error of Approximation (RMSEA)

The RMSEA is a fit index that tries to correct for chi-square in rejecting models (i.e. stating that the observed and estimated co-variance matrices differ significantly) with large sample sizes. RMSEA tries to deal with both sample size and model complexity.

Similarly, to SRMR, values below 0.10 for the RMSEA give an indication of an acceptable fit, with values below 0.05 suggesting a very good fit (Hair *et al.*, 2006).

5.12.3.6 Normed Fit Index (NFI)

Using a null model (which assumes that all observed variables are uncorrelated), the NFI evaluates how well the specified model fits the null model. According to Hair and others (2006), the NFI is influenced by small sample sizes, resulting in an underestimation of fit.

5.12.3.7 Comparative Fit Index (CFI)

The CFI is an improved fit statistic of the NFI. One of the advantages of the CFI is its relative robustness when dealing with large sample sizes. Values above 0.9 are considered to be an acceptable fit (Hair *et al.*, 2006).

5.12.3.8 Item parcelling

Item parcelling can be defined as the combining or adding of items into parcels that represent the factor. Item parcelling results in better-fitting solutions than measured by goodness-of-fit indices (Field, 2005). The reason for this improved fit is that when using parcelling it can be attributed to the fact that parcels represent more normally distributed characteristics than items do.

The better fit may also be because fewer data points need to fit in a confirmatory factor analysis model (Field, 2005).

5.12.3.9 Robust Maximum Likelihood method of estimation

In order to confirm the obtained structures of the dimensions of the questionnaire, CFA was used. Before conducting CFA, it is necessary to determine whether or not the data deviate from multivariate normality. If the data deviate from multivariate normality then Robust estimation techniques must be used during CFA. As the data were treated as continuous, the Robust maximum likelihood method of estimation was used (Byrne, 2005).

The following section reports the results regarding the factor structure of the questionnaire that was used on the various constructs in this study.

5.13 Psychometric properties for educator theory and beliefs

Two sub-dimensions were used for this variable. Twenty-two items were used to capture educator beliefs (assuming a unidimensional structure). Cronbach's Alpha was computed and returned a score of 0.629 (before correction). Two items (4.1 and 4.21) were removed because of insignificant factor loadings and the final Cronbach's Alpha after deletion was 0.805.

Assuming a two-dimensional structure, there were 14 items, which reported on negative beliefs, yielding a Cronbach's Alpha of 0.774. Eight items returned positive beliefs and reported a Cronbach's Alpha of 0.748. No items were removed.

The following section presents the results of the various statistical tests that were conducted. The results are presented, where applicable in the following order: (1) KMO and Bartlett's test, (2) Parallel analysis, (3) Total variance explained, (4) Pattern matrix, (5) Factor correlation matrix, and (6) Confirmatory factor analysis. Before deciding on how many factors can be extracted, it is essential to determine whether the variables can be factor-analysed.

This is done by calculating both the Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy and Bartlett's test of sphericity. Table 5.9 presents the results of this test.

Table 5.9 KMO-statistic and Bartlett's Test for educator theory and belief

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy	**0.794**	
Bartlett's Test of Sphericity	Approx. Chi-Square	4310.206
	df	231
	sig.	**0.000**

As illustrated Table 5.9, the Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy score is above 0.6.

This measure varies between 0 and 1. The values which are closer to 1 are recommended (Field, 2005). The values of 0.6 are regarded as a suggested minimum. Bartlett's test of sphericity is significant at ($p< 0.000$).

These two tests combined provide a minimum benchmark that must be passed before factor analysis or principal component analysis can be conducted. From Table 5.9, it is evident that the educator theory and beliefs construct can be factor-analysable due to the appropriate statistical levels.

According to the guidelines set for the KMO results which are 0.6, the factor structure can be analysed. Using the second guideline, which is Bartlett's test of Sphericity, the factor structure may be analysed because it is significant. The Chi-Square is a test statistic which is used to observe whether the Bartlett's test of Sphericity is significant.

In order to determine the number of factors to extract, Parallel analysis was conducted and the results are presented in Figure 5.4.

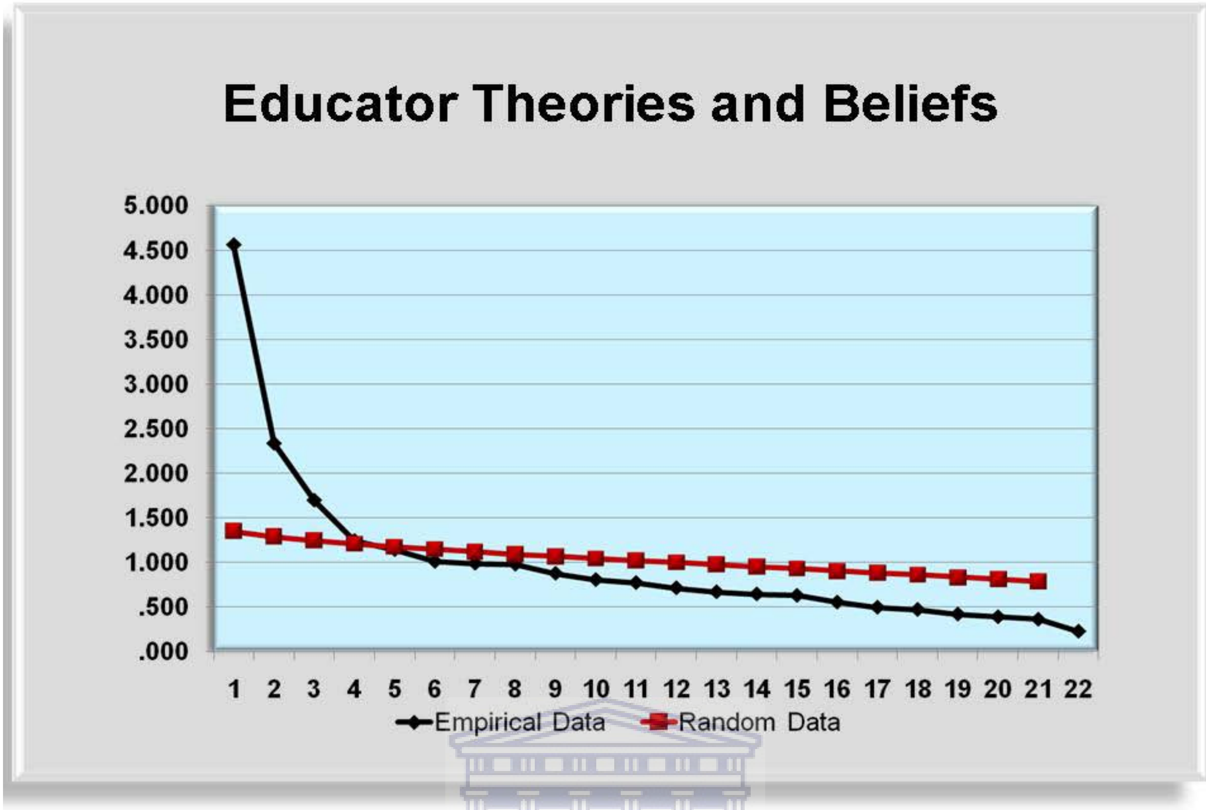

Figure 5.4: Parallel analysis on educators' theories and beliefs

As illustrated in Figure 5.4, it seems that a three-factor solution based on the results from the parallel analysis test is appropriate. It should be noted that a two-factor solution was chosen because the three-factor solution 'did not converge'.

The results of the two-factor solution are illustrated in Table 5.10.

Table 5.10 Total variance explained and eigenvalues: (theory and belief)

Total Variance Explained							
Factor	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings[a]
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total
1	4.565	20.751	20.751	3.859	17.543	17.543	3.209
2	2.336	10.616	31.367	1.632	7.418	24.961	2.994
3	1.697	7.713	39.080				
4	1.245	5.659	44.739				
5	1.144	5.198	49.937				
6	1.011	4.595	54.532				
7	0.990	4.498	59.030				
8	0.979	4.450	63.480				
9	0.877	3.985	67.465				
10	0.806	3.665	71.130				
11	0.774	3.516	74.646				
12	0.714	3.247	77.893				
13	0.670	3.046	80.939				
14	0.645	2.933	83.872				
15	0.629	2.859	86.732				
16	0.554	2.516	89.248				
17	0.496	2.256	91.504				
18	0.472	2.144	93.648				
19	0.419	1.906	95.554				
20	0.389	1.769	97.324				
21	0.361	1.643	98.967				
22	0.227	1.033	100.000				

Extraction Method: Principal Axis Factoring.

a. When factors are correlated, sums of squared loadings cannot be added to obtain a total variance.

As seen in Table 5.10, it is suggested that a two-factor solution could be used due to the extraction sum of squared loadings of eigenvalues being greater than one. The values in the ‘rotation sums of squared loadings’ represent the distribution of the variance after the oblique rotation.

Table 5.11 reports on the results of the EFA for a two-factor solution for the questionnaire that was used in this study. Pattern Matrix results are reported; and these resulted in a two-factor solution that loaded significantly on each of these two factors for the educator theory and belief construct.

Table 5.11 Pattern Matrix for educators' theory and belief (two-factor solution, final round)

Pattern Matrix[a]		
Questions	**Factor 1**	**Factor 2**
Q4.3	0.564	
Q4.2	0.559	
Q4.19	0.505	
Q4.5	0.495	
Q4.11	0.493	
Q4.4	0.474	
Q4.7	0.431	
Q4.16	0.420	
Q4.17	0.414	
Q4.12	0.394	
Q4.20	0.365	
Q4.6	0.336	
Q4.18	0.334	
Q4.13	0.321	
Q4.14		-0.699
Q4.10		-0.654
Q4.9		-0.645
Q4.22		-0.618
Q4.15		-0.467
Q4.21		-0.415
Q4.1		-0.363
Q4.8		-0.356
Extraction Method: Principal Axis Factoring. Rotation Method: Oblimin with Kaiser Normalization.		
a. Rotation converged in 5 iterations.		

Because an oblique rotation technique was used during the exploratory factor analysis, a pattern matrix (see Table 5.11) should be interpreted to identify the factor structure.

Table 5.12 Factor-correlation matrix

Factor Correlation Matrix		
Factor	1	2
1	1.000	-0.321
2	-0.321	1.000
Extraction Method: Principal Axis Factoring.	Rotation Method: Oblimin with Kaiser Normalisation.	

As illustrated in Table 5.12, two factors extracted from the educators' theory and belief construct, correlate negatively with each other. Furthermore, the table indicates that an oblique rotation occurred.

Table 5.13 Properties of the educators' theory and belief constructs measured in the present study

Model Comparison
Educator Theories and Beliefs

	Unidimensional (Removed items : 4.1 and 4.21: 6 Parcels)	**Two-dimensional** (All items:4 Parcels & 8 items)
S-B χ^2	70.2002	157.6839
df	9	53
RMSEA	0.092 (0.072; 0.112)	0.049 (0.040; 0.058)
CFI	0.942	0.933
NFI	0.934	0.904
SRMR	0.038	0.044

The results from Table 5.13 of the Confirmatory Factor Analysis suggest that all of the revalidated measures provided better-fit statistics than the original scores.

In addition, factor analysis was conducted and after a few rounds of testing, the final results are presented in Table 5.13.

All significant findings have been reported in this chapter. Due to the length of these reports, they were excluded from the appendix and are available on request.

5.14 Psychometric properties of access to computers

Six items under frequency-of-access to computers by educators were computed and scored a Cronbach's Alpha of 0.719. Removal of one item (5.4) was necessary because it had no significant factor loading.

Cronbach's Alpha was re-computed and returned an acceptable score of 0.746. Seven items under limitation associated with access to computers were computed and scored a Cronbach's Alpha of 0.817. No items were removed. Before deciding on how many factors can be extracted, it is essential to determine if the variables can be factor-analysed. This is done by calculating both the Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy and the Bartlett's test of sphericity. Table 5.14 presents the results of this test with regard to the limitation of access.

Table 5.14 KMO-statistic and Bartlett's Test for limitation to access

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		**0.841**
Bartlett's Test of Sphericity	Approx. Chi-Square	1702.419
	df	21
	Sig.	**0.000**

As illustrated in Table 5.14, the Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy score is above 0.6. This measure varies between 0 and 1. The values which are closer to 1 are recommended (Field, 2005). The value of 0.6 is regarded as a suggested minimum. Bartlett's test of sphericity is significant at ($p < 0.000$). These two tests combined provide a minimum benchmark that must be passed before factor analysis or principal component analysis can be conducted. From Table 5.14, it is evident that the educators' limitation-of-access to computers construct can be factor- analysable due to the appropriate statistical levels.

Table 5.15 Total variance explained and eigenvalues: (educators' limitation of access to computers)

Total Variance Explained						
Factor	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	3.364	48.063	48.063	2.788	39.825	39.825
2	0.952	13.601	61.664			
3	0.743	10.607	72.271			
4	0.652	9.308	81.579			
5	0.468	6.688	88.267			
6	0.444	6.337	94.603			
7	0.378	5.397	100.000			
Extraction Method: Principal Axis Factoring						

As seen in Table 5.15, it is suggested that a single factor solution could be used - due to the extraction sum of squared loadings of eigenvalues being greater than one. Table 5.16 reports on the results of the EFA for a single-factor solution regarding the questionnaire that was used in this study.

Table 5.16 Factor Matrix for limitation of educators' access to computers

Factor Matrix[a]	
Questions	**Factor 1**
Q 6.3	0.727
Q 6.1	0.709
Q 6.2	0.688
Q 6.6	0.632
Q 6.4	0.610
Q 6.7	0.551
Q 6.5	0.454
Extraction Method: Principal Axis Factoring.	a. 1 factors extracted. 5 iterations required.

Only Factor Matrix results are reported and those that resulted in a single-factor solution for the limitation-of-access to computers' construct. A second aspect that was measured with regard to access of computers is frequency of access.

Before deciding on how many factors can be extracted, it is essential to determine whether the variables can be factor analysed. This is done by calculating both the Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy and the Bartlett's test of sphericity. Table 5.17 presents the results of this test.

Table 5.17 KMO-statistic and Bartlett's Test for frequency of access

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.714
Bartlett's Test of Sphericity	Approx. Chi-Square	971.322
	df	10
	Sig.	**0.000**

As illustrated in Table 5.17, the Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy score is above 0.6 and the Bartlett's test of sphericity is significant at ($p< 0.000$). From Table 5.17 it is evident that the educators' frequency of access-to-computers construct can be factor analysed due to the appropriate statistical levels.

The results of the factor analysis are presented in Table 5.18.

Table 5.18 Total variance explained and eigenvalues: (educators' frequency of access to computers)

Factor	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	2.484	49.681	49.681	1.872	37.433	37.433
2	0.942	18.831	68.512			
3	0.721	14.428	82.940			
4	0.487	9.736	92.676			
5	0.366	7.324	100.000			

Total Variance Explained. Extraction Method: Principal Axis Factoring.

As seen in Table 5.18, it is suggested that a single-factor solution could be used on account of the extraction sum of squared loadings of eigenvalues being greater than one.

Table 5.19 reports on the results of the EFA for a single-factor solution for the questionnaire that was used in this study.

Table 5.19 Factor Matrix for frequency of educators' access to computers (final round)

Factor Matrix[a]	
Questions	**Factor 1**
Q 5.6	0.692
Q 5.5	0.672
Q 5.1	0.596
Q 5.2	0.569
Q 5.3	0.512
Extraction Method: Principal Axis Factoring	a. 1 factors extracted. 5 iterations required

Only Factor Matrix results are reported; and these resulted in a single-factor solution for the frequency-of-access to computers' construct.

5.15 Psychometric properties of educator attitudes towards computers

Assuming a unidimensional structure, there were 18 items that measured educators' attitudes towards computers. One item (7.16) was removed because it had no significant factor loading. After deletion, Cronbach's Alpha returned an acceptable coefficient of 0.875. Assuming a two-dimensional structure for educators' attitudes towards computers, seven items on positive attitudes returned a Cronbach's Alpha of 0.774; and on ten negative attitudes a score of 0.800 was returned.

One item was removed because of significant cross-loadings. Before deciding on how many factors can be extracted, it is essential to determine whether the variables can be factor-analysed. This is done by calculating both the Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy and Bartlett's test of sphericity. Table 5.20 presents the results of this test.

Table 5.20 KMO-statistic and Bartlett's Test for the educators' attitude towards computers

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.890
Bartlett's Test of Sphericity	Approx. Chi-Square	3932.704
	df	136
	Sig.	**0.000**

As illustrated in Table 5.20, the Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy score is above 0.6 and the Bartlett's test of sphericity is significant at ($p< 0.000$). From Table 5.20, it is evident that the educator-attitude construct can be factor-analysed due to the appropriate statistical levels.

In order to determine the number of factors to extract, Parallel analysis was conducted and the results are presented in Figure 5.5.

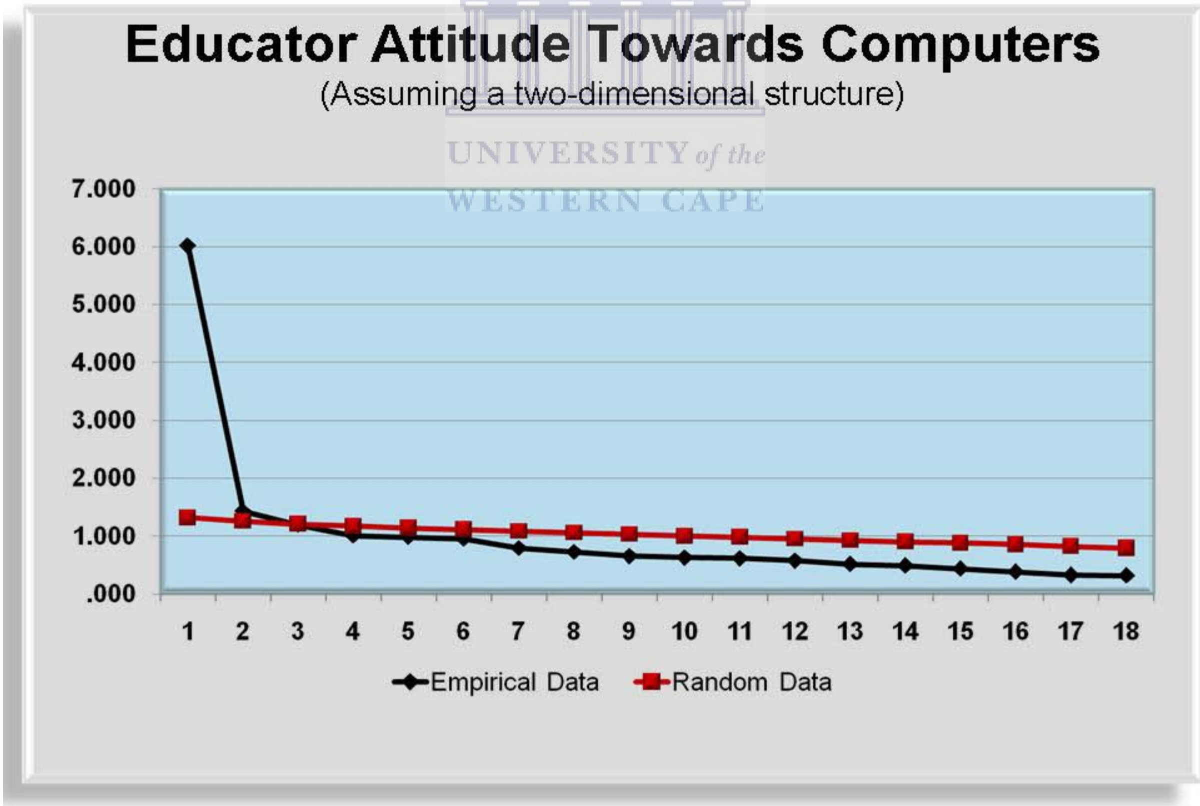

Figure 5.5: Parallel Analysis for educators' attitude towards computers

As illustrated in Figure 5.5, it seems that a two-factor solution based on the results from the parallel analysis test is appropriate. The results of the two-factor solution are illustrated in Table 5.21.

Table 5.21 Total variance explained and eigenvalues: (educator attitude)

Total Variance Explained							
Factor	**Initial Eigenvalues**			**Extraction Sums of Squared Loadings**			**Rotation Sums of Squared Loadings[a]**
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total
1	5.522	32.479	32.479	4.888	28.752	28.752	4.154
2	1.424	8.378	40.858	.812	4.778	33.529	4.068
3	1.181	6.947	47.804				
4	.997	5.862	53.667				
5	.954	5.610	59.277				
6	.856	5.036	64.314				
7	.790	4.648	68.962				
8	.719	4.229	73.190				
9	.641	3.768	76.959				
10	.625	3.677	80.636				
11	.612	3.597	84.233				
12	.556	3.268	87.501				
13	.515	3.029	90.530				
14	.483	2.840	93.370				
15	.434	2.551	95.921				
16	.371	2.182	98.103				
17	.323	1.897	100.000				
Extraction Method: Principal Axis Factoring							
a. When factors are correlated, sums of squared loadings cannot be added to obtain a total variance.							

As seen in Table 5.21, it is suggested that a two-factor solution could be used on account of the extraction sum of squared loadings of eigenvalues being greater than one.

Table 5.22 reports on the results of the EFA for a two-factor solution for the questionnaire that was used in this study. Only Pattern Matrix results are reported; and these resulted in a two-factor solution for the educators' attitude towards the computer construct. Because an oblique rotation technique was used during the exploratory factor analysis, a pattern matrix (see Table 5.22) should be interpreted to identify the factor structure. Due to the length of this report, the full result has been excluded from the appendices, but is available on request.

Table 5.22 Pattern Matrix for educators' attitude towards computers (final round)

Pattern Matrix[a]		
Questions	**Factor 1**	**Factor 2**
Q 7.12	0.666	
Q 7.10	0.561	
Q 7.11	0.553	
Q 7.17	0.518	
Q 7.18	0.492	
Q 7.9	0.488	
Q 7.14	0.444	
Q 7.16	0.427	
Q 7.8	0.412	
Q 7.6	0.385	
Q 7.4		-0.915
Q 7.5		-0.669
Q 7.3		-0.621
Q 7.2		-0.482
Q 7.15		-0.433
Q 7.13		-0.362
Q 7.1		-0.347
Extraction Method: Principal Axis Factoring	Rotation Method: Oblimin with Kaiser Normalization	
a. Rotation converged in 8 iterations		

Table 5.23 Factor-Correlation Matrix

Factor Correlation Matrix		
Factor	**1**	**2**
1	1.000	-0.619
2	-0.619	1.000

Extraction Method: Principal Axis Factoring. Rotation Method: Oblimin with Kaiser Normalization.

As illustrated in Table 5.23, two factors extracted from the educators' attitude construct correlate negatively with each other. The results of the Confirmatory Factor Analysis (CFA) for the independent variable of educators' attitudes towards computers are presented in Table 5.24.

Table 5.24 Properties of the educators' attitude towards computers measured in the present study

Lisrel: Model Comparison

Attitudes

	Unidimensional (Removed item 16) RML	**Two-dimensional: Items** (Removed item 7) RML	**Two-dimensional: Parcels** (Removed item 7) RML
S-B χ^2	728.36	529.95	184.89
df	119	118	34
RMSEA	0.079 (0.075; 0.084)	0.066 (0.060; 0.071)	0.074 (0.064; 0.085)
CFI	0.94	0.96	0.97
NFI	0.93	0.94	0.96
SRMR	0.064	0.055	0.049

The results from Table 5.24 of the Confirmatory Factor Analysis suggest that all of the revalidated measures provided better-fit statistics than the original measurements. In addition, factor analysis was conducted and after a few rounds of testing, the final results are presented in Table 5.24.

5.16 Psychometric properties of educator support in using computers

Two sub-dimensions were constructed for this variable. Assuming a unidimensional structure, ten items were computed for educator support. Before correction, Cronbach's Alpha yielded a score of 0.610. Two items were found to be negatively worded, based on item-total correlations. No items were removed and after corrections Cronbach's Alpha returned an acceptable score of 0.790.

Assuming a two-dimensional structure for educator support, using Parallel Analysis, Cronbach's Alpha yielded a score of 0.730 on the six items addressing administration support. Collegial support consisted of three items and Cronbach's Alpha retuned a score of 0.720. One item (8.1) was removed due to significant cross loading.

Before deciding on how many factors can be extracted, it is essential to determine whether the variables can be factor-analysed. This is done by calculating both the Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy and the Bartlett's test of sphericity. Table 5.25 presents the results of this test.

Table 5.25 KMO-statistic and Bartlett's Test for the educators' support on computers

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		0.730
Bartlett's Test of Sphericity	Approx. Chi-Square	2061.951
	df	36
	Sig.	**0.000**

As illustrated in Table 5.25, the Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy score is above 0.6. This measure varies between 0 and 1. Those values which are closer to 1 are recommended (Field, 2005). The values below 0.6 are regarded as below the suggested minimum. Bartlett's test of sphericity is significant at ($p < 0.000$). These two tests combined provide a minimum benchmark that must be passed before factor analysis or principal component analysis can be conducted. From Table 5.25, it is evident that the support construct can be factor-analysed on account of the appropriate statistical levels.

According to the guidelines set for the KMO results which are 0.6, the factor structure can be analysed. Using the second guideline, which is Bartlett's test of Sphericity, the factor structure may be analysed because it is significant. The Chi-Square is a test statistic which is used to observe whether the Bartlett's test of Sphericity is significant.

In order to determine the number of factors to extract, Parallel analysis was conducted and the results are presented in Figure 5.6.

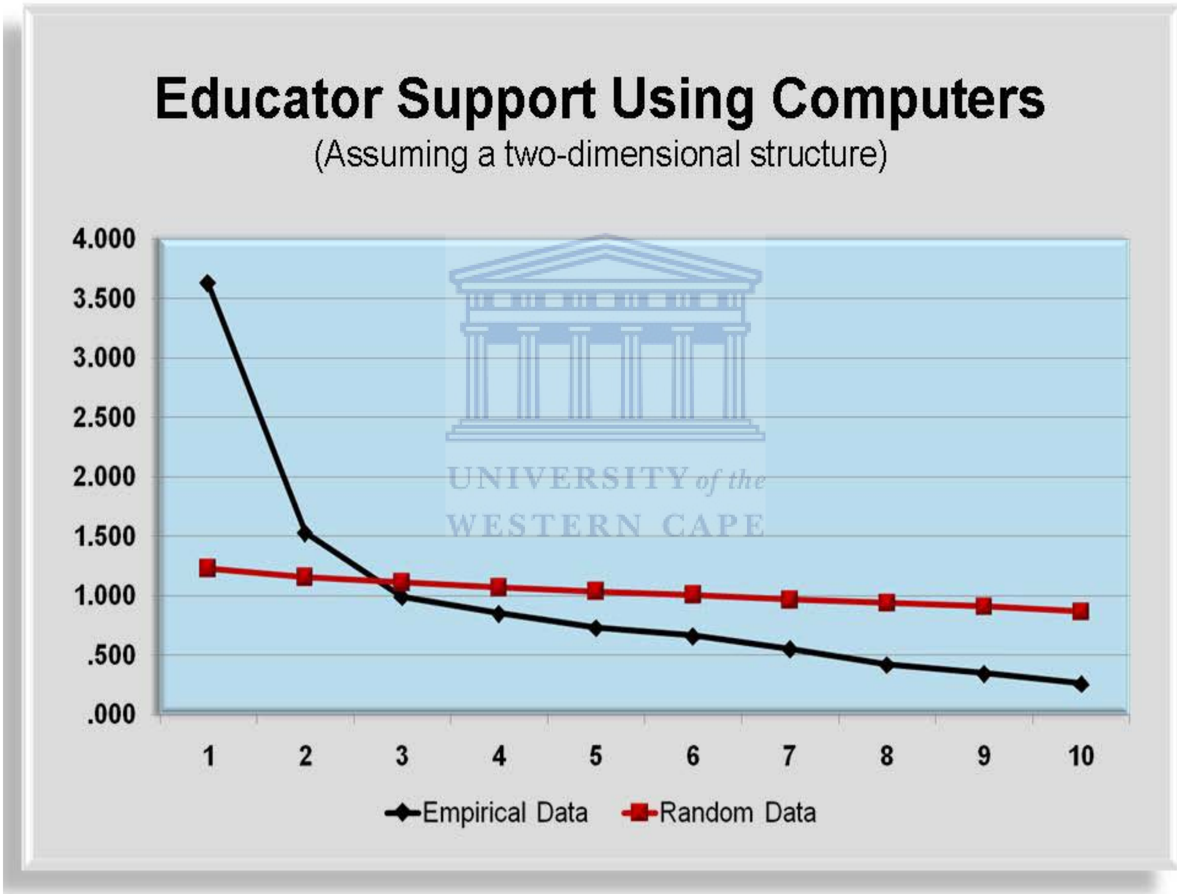

Figure 5.6: Parallel Analysis for educators' support on computers

As illustrated in Figure 5.6, it seems that a two-factor solution based on the results from the parallel analysis test is appropriate. The results of the two-factor solution are illustrated in Table 5.26.

Table 5.26 Total variance explained and eigenvalues: (support)

Total Variance Explained							
Factor	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings[a]
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total
1	3.238	35.978	35.978	2.696	29.959	29.959	2.111
2	1.530	17.005	52.983	0.940	10.450	40.409	2.093
3	0.957	10.638	63.621				
4	0.823	9.148	72.769				
5	0.726	8.062	80.831				
6	0.664	7.381	88.213				
7	0.447	4.962	93.175				
8	0.351	3.897	97.072				
9	0.264	2.928	100.000				

Extraction Method: Principal Axis Factoring

a. When factors are correlated, sums of squared loadings cannot be added to obtain a total variance.

As seen in Table 5.26, it is suggested that a two-factor solution could be used due to the extraction sum of the squared loadings of eigenvalues being greater than one.

When oblique rotation is used, then the output is a pattern matrix. However, when there is more than one factor, one need to interpret where these factors lie; hence a pattern matrix is used to determine the pattern of factor loadings (see Table 5.27). Nevertheless, if there is a single dimension or single factor, then there is no pattern matrix, because it cannot find a pattern.

According to Hair and others (2006, p.123), factor loadings "indicate the degree of correspondence between the variable and the factor, with higher loadings making the variable representative of the factor". Hence, the factor-pattern matrix has loadings that represent the distinct contribution of each variable to the factor.

Table 5.27 Pattern Matrix for educators' support on computers (final round)

Pattern Matrix[a]		
Questions	Factor 1	Factor 2
Q 8.8	0.640	
Q 8.9	0.628	
Q 8.10	0.567	
Q 8.6	0.509	
Q 8.2	0.461	
Q 8.7	0.351	
Q 8.4		-0.807
Q 8.3		-0.685
Q 8.5		-0.546
Extraction Method: Principal Axis Factoring	Rotation Method: Oblimin with Kaiser Normalization	
a. Rotation converged in 9 iterations		

Table 5.27 reports on the results of the EFA for a two-factor solution regarding the questionnaire that was used in this study. Only Pattern-Matrix results are reported; and these resulted in a two-factor solution for the educators' support on computers construct. Due to the length of this report, the detailed analysis was not included, but is available on request.

Table 5.28 Factor-Correlation Matrix

Factor Correlation Matrix		
Factor	1	2
1	1.000	-0.323
2	-0.323	1.000
Extraction Method: Principal Axis Factoring	Rotation Method: Oblimin with Kaiser Normalization	

Because an oblique rotation technique was used during the exploratory factor analysis, a pattern matrix (see Table 5.27) should be interpreted to identify the factor structure. As illustrated in Table 5.28, two factors extracted from the educators' support construct correlate negatively with each other.

The results of the Confirmatory Factor Analysis (CFA) for the independent variable of educators' support are presented in Table 5.29.

Table 5.29 Properties of the educators' support on computers measured in the present study

Lisrel: Model Comparison

Support

	Unidimensional (All items) RML	**Two-dimensional: Items** (Removed item 1) RLS **
S-B χ^2	643.50	226.37
df	35	26
RMSEA	0.15 (0.14; 0.16)	0.097 (0.086; 0.11)
CFI	0.83	0.93
NFI	0.82	0.92
SRMR	0.10	0.076

The results from Table 5.29 of the Confirmatory Factor Analysis suggest that all of the revalidated measures provided better-fit statistics than the original measurements. In addition, factor analysis was conducted and after a few rounds of testing, the final results are presented in Table 5.29.

5.17 Psychometric properties for educator training in using computers

Three sub-dimensions were constructed for this variable. Nine items measured the consequences of computer training and yielded a Cronbach's Alpha of 0.927. Based on item-total correlations, no negatively worded items were found and, in addition, no items were removed. Seven items were computed to measure the value of the computer training; and these scored a Cronbach's Alpha of 0.866.

No items were removed and there were no negatively worded items. Six items were used to measure the importance of computer training and scored a Cronbach's Alpha of 0.858. Based on item-total correlations, no negatively worded items were found; and, in addition, no items were removed.

The section below reports on the three sub-dimensions of the training construct, namely: consequence, value and importance of educator computer training. Before deciding on how many factors can be extracted, it is essential to determine whether the variables can be factor-analysed. This is done by calculating both the Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy and the value for the Bartlett's test of sphericity. Table 5.30 presents the results of these tests.

Table 5.30 KMO-statistic and Bartlett's Test for the consequence of training

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy		0.915
Bartlett's Test of Sphericity	Approx. Chi-Square	4840.561
	df	36
	Sig.	**0.000**

As illustrated in the above table, the Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy score is above 0.6. This measure varies between 0 and 1. The values which are closer to 1 are recommended (Field, 2005). The value of 0.6 is regarded as the suggested minimum. Bartlett's test of sphericity is significant at ($p< 0.000$).

These two tests combined provide a minimum benchmark that must be passed before factor analysis or principal component analysis can be conducted. From Table 5.30, it becomes evident that the consequence of the training construct can be factor-analysed on account of the appropriate statistical levels. The factor analysis is presented in Table 5.31.

According to the guidelines set for the KMO results which are 0.6, the factor structure can be analysed. Using the second guideline, which is Bartlett's test of Sphericity, the factor structure may be analysed because it is significant. The Chi-Square is a test statistic which is used to observe whether the Bartlett's test of Sphericity is significant.

Table 5.31 Total variance explained and eigenvalues: (consequence of training)

Total Variance Explained						
Factor	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	5.694	63.266	63.266	5.306	58.953	58.953
2	0.934	10.377	73.643			
3	0.551	6.126	79.769			
4	0.458	5.088	84.857			
5	0.384	4.266	89.123			
6	0.312	3.468	92.590			
7	0.275	3.052	95.642			
8	0.212	2.361	98.003			
9	0.180	1.997	100.000			
Extraction Method: Principal Axis Factoring						

As seen in Table 5.31, it is suggested that a single-factor solution could be used on account of the extraction sum of squared loadings of eigenvalues being greater than one.

Table 5.32 reports on the results of the EFA for a single-factor solution for the questionnaire that was used in this study. Only Factor-Matrix results are reported; and these resulted in a single-factor solution for the training construct. Due to the length of the report, the detailed result of the analysis has been excluded from the appendix and is available on request. However, Appendix K provides an indication of the information presented in an Exploratory Factor Analysis report. This report contains the information from the pedagogy variable used in this study.

Table 5.32 Factor Matrix for consequences of training (final round)

Factor Matrix[a]	
Questions	Factor 1
Q 11.8	0.860
Q 11.6	0.830
Q 11.5	0.829
Q 11.4	0.794
Q 11.7	0.790
Q 11.3	0.753
Q 11.9	0.750
Q 11.2	0.699
Q 11.1	0.564
Extraction Method: Principal Axis Factoring	a. 1 factors extracted, 4 iterations required

A second aspect of training that was investigated is the value of training. The results are presented in the tables below.

Table 5.33 KMO-statistic and Bartlett's Test for the value of training

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy		0.872
Bartlett's Test of Sphericity	Approx. Chi-Square	3031.831
	df	21
	Sig.	**0.000**

As illustrated in Table 5.33, the Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy score is above 0.6. This measure varies between 0 and 1. The values which are closer to 1 are recommended (Field, 2005). The value of 0.6 is regarded as a suggested minimum. Bartlett's test of sphericity is significant at ($p< 0.000$).

These two tests combined provide a minimum benchmark that must be passed before factor analysis or principal component analysis can be conducted. From Table 5.33 it becomes evident that the value of the training construct can be factor analysed on account of the appropriate statistical levels.

Table 5.34 Total variance explained and eigenvalues: (value of training)

Total Variance Explained						
Factor	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	4.158	59.400	59.400	3.758	53.688	53.688
2	0.901	12.868	72.268			
3	0.579	8.276	80.544			
4	0.470	6.711	87.254			
5	0.426	6.088	93.342			
6	0.251	3.584	96.926			
7	0.215	3.074	100.000			
Extraction Method: Principal Axis Factoring						

As seen in Table 5.34, it is suggested that a single-factor solution could be used because of the extraction sum of the squared loadings of eigenvalues being greater than one. Table 5.35 reports on the results of the EFA for a single-factor solution for the questionnaire that was used in this study. Only Factor Matrix results are reported and these resulted in a single-factor solution for the value of the training construct. The full report is available on request.

Table 5.35 Factor Matrix for value of training (final round)

Factor Matrix[a]	
Questions	Factor 1
Q 12.4	0.878
Q 12.7	0.813
Q 12.3	0.781
Q 12.5	0.758
Q 12.2	0.730
Q 12.6	0.702
Q 12.1	0.341
Extraction Method: Principal Axis Factoring	a. 1 factors extracted, 5 iterations required

A third aspect of training that was investigated is the importance of training. The results of the analyses are represented in the tables below.

Table 5.36 KMO-statistic and Bartlett's Test for the <u>importance</u> of training

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy		0.882
Bartlett's Test of Sphericity	Approx. Chi-Square	1912.200
	df	15
	Sig.	**0.000**

As illustrated in Table 5.36, the Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy score is above 0.6 and the Bartlett's test of sphericity is significant at (p< 0.000). From Table 5.36, it becomes evident that the importance of the training construct can be factor-analysed because of the appropriate statistical levels. The factor analysis is presented in Table 5.37.

Table 5.37 Total variance explained and eigenvalues: (importance of training)

Total Variance Explained						
Factor	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	3.547	59.114	59.114	3.075	51.254	51.254
2	.646	10.759	69.873			
3	.559	9.320	79.193			
4	.498	8.299	87.492			
5	.441	7.348	94.840			
6	.310	5.160	100.000			
Extraction Method: Principal Axis Factoring						

As seen in Table 5.37, it is suggested that a single-factor solution could be used on account of the extraction sum of the squared loadings of the eigenvalues being greater than one.

Table 5.38 reports on the results of the EFA for a single-factor solution for the questionnaire that was used in this study.

Only Factor-Matrix results are reported and these resulted in a single-factor solution for the importance of the training construct. The detailed analysis of the results have not been included in the study, but is available on request.

Table 5.38 Factor Matrix for the importance of training

Factor Matrix[a]	
Questions	**Factor 1**
Q 13.4	0.806
Q 13.3	0.798
Q 13.5	0.710
Q 13.6	0.684
Q 13.2	0.663
Q 13.1	0.615
Extraction Method: Principal Axis Factoring	a. 1 factors extracted, 5 iterations required

5.18 Psychometric properties for educator pedagogy

Three sub-dimensions were constructed for this variable. Educator pedagogy in totality was measured using 20 items. Exploratory Factor Analysis suggested three distinct factors; hence, no Parallel Analysis testing was necessary for the variable pedagogy. Seven items were used to measure pedagogy importance and yielded a Cronbach's Alpha of 0.897. Eight items measured pedagogy confidence and yielded a Cronbach's Alpha of 0.954. Five items measured pedagogy productivity and yielded a Cronbach's Alpha of 0.838. Based on the item-total correlations, no negatively worded items were found; and in addition, no items were removed. Before deciding on how many factors can be extracted, it is essential to determine whether the variables can be factor-analysed.

Table 5.39 KMO-statistic and Bartlett's Test for educator pedagogy

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy		0.927
Bartlett's Test of Sphericity	Approx. Chi-Square	11940.859
	df	190
	Sig.	**0.000**

As illustrated in Table 5.39, the Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy score is above 0.6 and the Bartlett's test of sphericity is significant at ($p < 0.000$). From Table 5.39 it is evident that the educator pedagogy construct can be factor analysed due to the appropriate statistical levels. The factor analysis is presented in Table 5.40.

Table 5.40 Total variance explained and eigenvalues: (pedagogy)

Total Variance Explained							
Factor	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings[a]
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total
1	8.023	40.116	40.116	7.678	38.389	38.389	6.491
2	4.040	20.200	60.316	3.687	18.437	56.826	5.643
3	1.516	7.582	67.898	1.078	5.391	62.217	4.882
4	0.991	4.957	72.855				
5	0.682	3.411	76.266				
6	0.570	2.852	79.118				
7	0.483	2.413	81.530				
8	0.469	2.346	83.877				
9	0.423	2.115	85.991				
10	0.376	1.879	87.870				
11	0.355	1.773	89.643				
12	0.308	1.541	91.184				
13	0.272	1.362	92.547				
14	0.271	1.357	93.903				
15	0.250	1.252	95.155				
16	0.242	1.212	96.368				
17	0.212	1.062	97.430				
18	0.189	0.946	98.376				
19	0.178	0.892	99.267				
20	0.147	0.733	100.000				

a. When factors are correlated, sums of squared loadings cannot be added to obtain a total variance.

As can be seen in Table 5.40, it is suggested that a three-factor solution could be used due to the extraction sum of squared loadings of the eigenvalues being greater than one.

Table 5.41 reports on the results of the EFA for a three-factor solution for the questionnaire that was used in this study. Only Pattern-Matrix results are reported; and these resulted in a three-factor solution for the educator pedagogy construct. The detailed analysis is available on request. Because an oblique rotation technique was used during the exploratory factor analysis, a pattern matrix (see Table 5.41) should be interpreted to identify the factor structure.

Table 5.41 Pattern Matrix for educators' pedagogy

Pattern Matrix[a]			
Questions	**Factor 1**	**Factor 2**	**Factor 3**
Q 15.7	0.898		
Q 15.5	0.884		
Q 15.8	0.868		
Q 15.6	0.857		
Q 15.3	0.850		
Q 15.2	0.828		
Q 15.4	0.809		
Q 15.1	0.798		
Q 14.4		0.856	
Q 14.3		0.830	
Q 14.5		0.815	
Q 14.6		0.780	
Q 14.7		0.703	
Q 14.1		0.616	
Q 14.2		0.603	
Q 16.3			0.819
Q 16.4			0.792
Q 16.1			0.654
Q 16.2			0.654
Q 16.5			0.607
Extraction Method: Principal Axis Factoring		Rotation Method: Oblimin with Kaiser Normalization	
a. Rotation converged in 6 iterations			

Table 5.42 Factor-correlation matrix

Factor-Correlation Matrix			
Factor	1	2	3
1	1.000	0.299	0.323
2	0.299	1.000	0.637
3	0.323	0.637	1.000

Extraction Method: Principal Axis Factoring Rotation Method: Oblimin with Kaiser Normalization

As illustrated in Table 5.42, three factors extracted from the educators' support construct correlate positively with each other. The results of the Confirmatory Factor Analysis (CFA) for the independent variable educators' support are presented in Table 5.43.

Table 5.43 Model comparison for pedagogy measured in the present study

Lisrel: Model Comparison

Pedagogy

	Unidimensional (All items) RML	**Three-dimensional: Items** (All items) RML
S-B χ^2	8302.09	958.35
df	172	167
RMSEA	0.24 (0.24; 0.25)	0.076 (0.072; 0.081)
CFI	0.69	0.97
NFI	0.69	0.96
SRMR	0.23	0.047

The results from Table 5.43 of the Confirmatory Factor Analysis suggest that all of the revalidated measures provided better-fit statistics than the original measurements. In addition, factor analysis was conducted and after a few rounds of testing, the final results are presented in Table 5.43.

5.19 Psychometric properties for the dependent variable

Assuming a unidimensional structure, the dependent variable, namely the use of computers, was measured using 18 items. After computing Cronbach's Alpha, it yielded a score of 0.960. Based on item-total correlations, no negatively worded items were found and, in addition, no items were removed. Assuming a two-dimensional structure and using Parallel Analysis, nine items were found in the dependent variable for functionality, yielding a Cronbach's Alpha of 0.948.

For the second sub-dimension procedure, five items were found scoring a Cronbach's Alpha of 0.884. Four items (17.6; 17.14; 17.15; 17.16) were removed because they presented significant cross-loadings.

Table 5.44 KMO-statistic and Bartlett's Test for the dependent variable

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		0.938
Bartlett's Test of Sphericity	Approx. Chi-Square	9667.038
	df	0.91
	Sig.	**0.000**

As illustrated in Table 5.44, the Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy score is above 0.6. This measure varies between 0 and 1. The values which are closer to 1 are recommended (Field, 2005), while the value of 0.6 is regarded as a minimum. Bartlett's test of sphericity is significant at (p< 0.000).

These two tests combined provide a minimum benchmark that must be passed before factor analysis or principal component analysis can be conducted. From Table 5.44, it becomes evident that the dependent variable construct can be factor-analysed on account of the appropriate statistical levels.

In order to determine the number of factors to extract, parallel analysis was conducted and the results are presented in Figure 5.7.

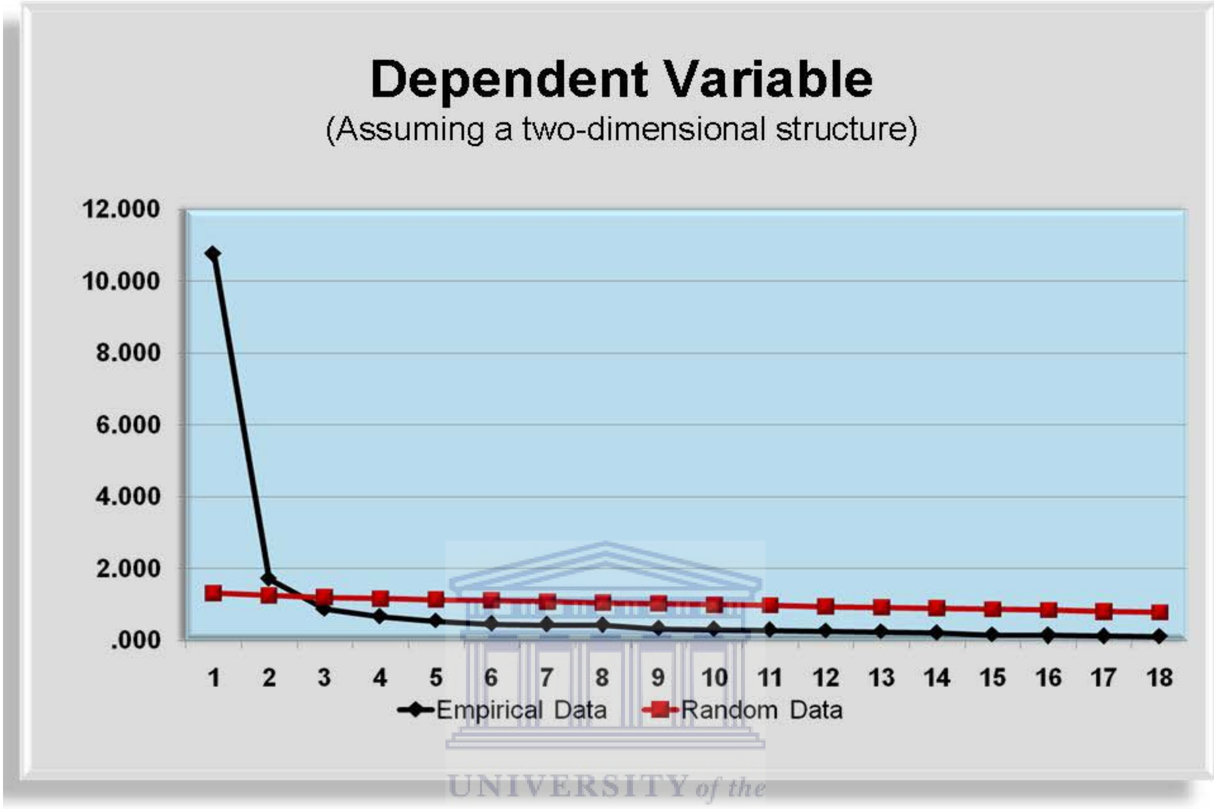

Figure 5.7: Parallel analysis for the dependent variable

As illustrated in Figure 5.7, it seems that a two-factor solution based on the results from the parallel analysis test is appropriate. The results of the two-factor solution are presented in Table 5.45.

Table 5.45 Total variance explained and eigenvalues: (dependent variable)

Total Variance Explained							
Factor	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings[a]
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total
1	8.285	59.179	59.179	7.974	56.957	56.957	7.506
2	1.663	11.878	71.058	1.297	9.261	66.218	5.590
3	0.628	4.484	75.541				
4	0.611	4.362	79.903				
5	0.470	3.354	83.257				
6	0.440	3.143	86.400				
7	0.373	2.664	89.065				
8	0.327	2.336	91.400				
9	0.290	2.072	93.472				
10	0.276	1.969	95.441				
11	0.220	1.571	97.012				
12	0.167	1.191	98.203				
13	0.136	.970	99.173				
14	0.116	.827	100.000				

Extraction Method: Principal Axis Factoring

a. When factors are correlated, sums of squared loadings cannot be added to obtain a total variance.

As seen in Table 5.45, it is suggested that a two-factor solution could be used because the extraction sum of the squared loadings of the eigenvalues is greater than one.

Table 5.46 reports on the results of the EFA for a two-factor solution for the questionnaire that was used in this study. Only Pattern-Matrix results are reported; and these resulted in a two-factor solution for the dependent variable construct. The detailed analysis is available on request.

Table 5.46 Pattern matrix for the dependent variable

Pattern Matrix[a]		
Questions	**Factor 1**	**Factor 2**
Q 17.12	0.936	
Q 17.11	0.878	
Q 17.8	0.869	
Q 17.13	0.843	
Q 17.7	0.807	
Q 17.18	0.802	
Q 17.10	0.789	
Q 17.17	0.654	
Q 17.9	0.625	
Q 17.4		0.833
Q 17.3		0.774
Q 17.2		0.733
Q 17.5		0.686
Q 17.1		0.661
Extraction Method: Principal Axis Factoring	Rotation Method: Oblimin with Kaiser Normalization	
a. Rotation converged in 4 iterations		

Because an oblique rotation technique was used during the exploratory factor analysis, a pattern matrix (see Table 5.46) should be interpreted to identify the factor structure.

Table 5.47 Factor-correlation matrix

Factor Correlation Matrix		
Factor	1	2
1	1.000	0.615
2	0.615	1.000
Extraction Method: Principal Axis Factoring	Rotation Method: Oblimin with Kaiser Normalization	

As illustrated in Table 5.47, two factors extracted from the dependent variable construct correlate positively with each other. Factor analysis was conducted; and after a few rounds of testing, the final results are presented in Table 5.48.

Table 5.48 Model comparison for the dependent variable measured in the present study

Lisrel: Model Comparison
Dependent variable

	Unidimensional (All items) RML	**Two-dimensional: Items** (Removed 17.6; 17.14; 17.15; and 17.16) RML
S-B χ^2	3402.79	784.55
df	135	76
RMSEA	0.17 (0.17; 0.18)	0.11 (0.10; 0.12)
CFI	0.92	0.97
NFI	0.92	0.97
SRMR	0.080	0.047

The results from Table 5.48 of the Confirmatory Factor Analysis suggest that all of the revalidated measures provided better-fit statistics than the original measurements.

Based on the extensive rigour of the statistical techniques employed above, Table 5.49 provides a scale of the dimensions that will be used in this study.

Table 5.49 Scale of dimensions to be used in the present study

Questions	Description	Dimensions
Question 4	Educator beliefs	2
Question 5	Frequency of access to computers at school	1
Question 6	Limitations of access to computers at school	1
Question 7	Educator attitudes towards computers	2
Question 8	Educator support using computers	2
Question 11	Consequences of computer usage	1
Question 12	Value of computer training	1
Question 13	Importance of computer training	1
Questions 14,15,16	Educator pedagogy	3
Question 17	Educator skills (dependent variable)	2

The next section provides a summary of the statistical analysis and techniques used to answer each of the research objectives in this study.

5.20 Statistical analysis and techniques used

Research question one: Determine to what extent secondary school educators in the Western Cape central metropole use computers to deliver their lessons in the classroom. Statistical techniques such as descriptive statistics, mean, standard deviation, skewness and correlations will be used.

Research question two: Determine secondary school educators' theories and beliefs on computer usage. Descriptive statistics such as the mean, standard deviation, correlations and skewness will be used.

Research question three: Determine secondary school educators' access to use of computers. Descriptive statistics, such as the mean, standard deviation, skewness and correlations will be used.

Research question four: Determine what the impact is on secondary school educators' attitudes of using computers for teaching purposes.

Descriptive statistics, such as the mean, the standard deviation, skewness, correlations, multiple regression and tests of differences (T-test and ANOVA) will be used.

Research question five: Determine what support the educators receive to use computers for teaching purposes. Descriptive statistics, such as the mean, the standard deviation, skewness and correlations will be used

Research question six: Determine whether training makes any difference in the level of computer use by educators. Tests of differences (T-test and ANOVA) will be used.

Additional questions: Which educator pedagogical factors determine the use or non-use of computers for teaching purposes? Correlations and tests of differences (T-test and ANOVA) will be used.

Additional questions: Identify the relationships between the dependent variable and the independent variables. Correlations and multiple regressions will be used.

Additional questions: Investigate which of the six independent variables provides the highest amount of variance to the dependent variable. Multiple regressions will be used.

5.21 Summary

This chapter has described the methods, techniques and procedures employed to collect data used in this study.

Figure 5.8 below provides an illustration of all the variables that has been discussed in this chapter.

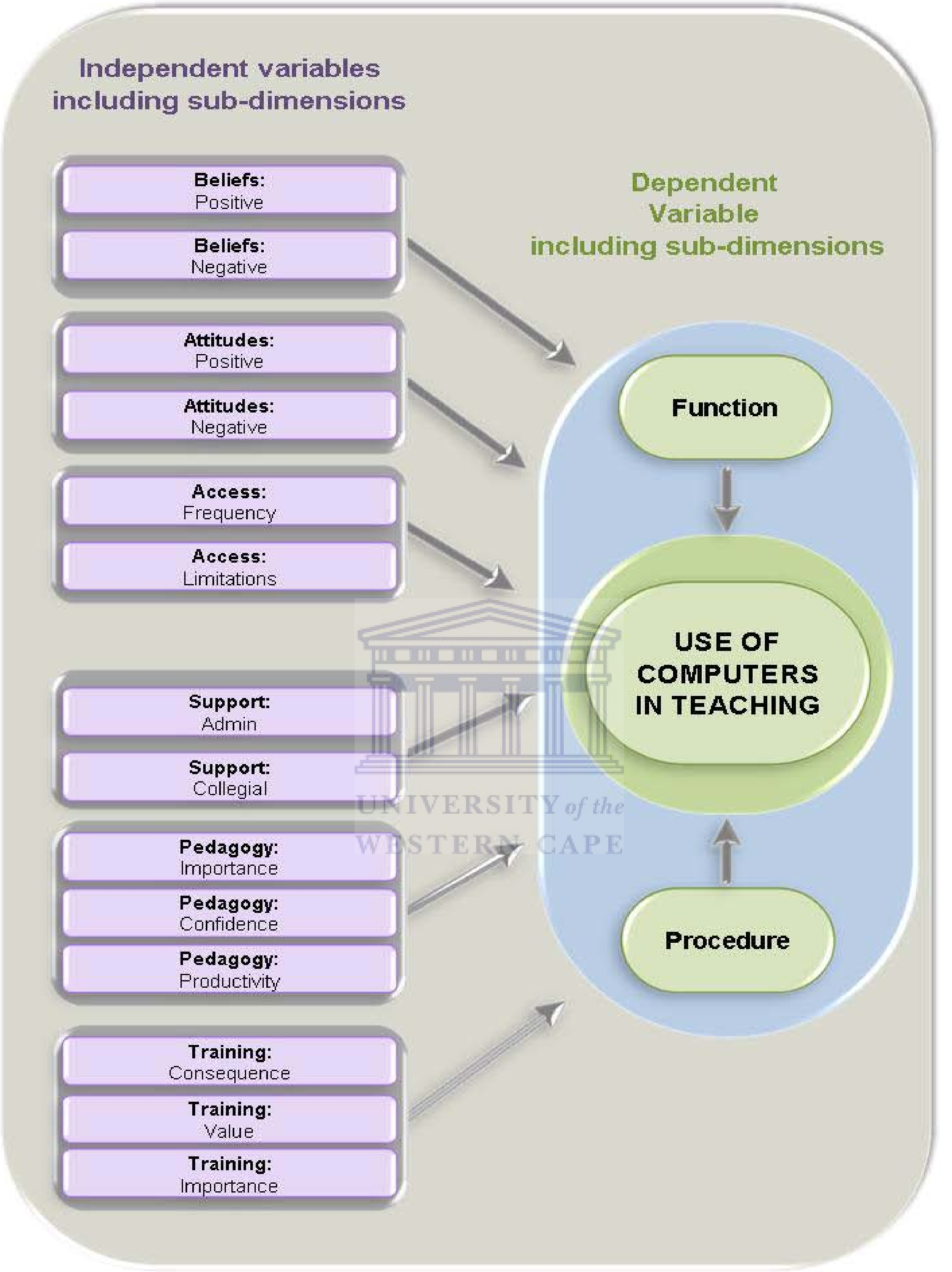

Figure 5.8: Model summary of independent and dependent variables

The following chapter presents the findings of the results for the quantitative part of the empirical study.

CHAPTER 6

RESULTS OF THE QUANTITATIVE SURVEY AMONGST EDUCATORS

6.1 Introduction

This chapter presents the quantitative findings of this study and reveals the statistical data that highlight the relationships among the six independent variables and the dependent variable. This study was designed to identify and assess factors that influence secondary school educators to use computers in their teaching and to identify the extent to which educators are utilising computers in their instruction.

Chapter 6 will also provide statistical results that are applicable to the research questions in this study. The first part of this chapter discusses the biographical and descriptive data, while the second part provides illustrations of the various statistical results. The data for this study were collected through hand-delivered survey questionnaires that targeted educators in secondary schools in the Western Cape central metropole.

The following section reports on the descriptive, explanatory and predictive analysis of the data.

6.2 Description of gender

The descriptive statistics relating to the gender of the secondary school educators who participated in the survey in the Western Cape central metropole are presented in Table 6.1. It should be noted that principals are excluded from these statistics. A separate questionnaire was developed for the principals and this will be discussed in Chapter 7.

Table 6.1 Descriptive statistics for the gender of secondary school educators

Gender	Frequency	Percent	Valid Percent	Cumulative Percent
Male	341	42.0	42.0	42.0
Female	471	58.0	58.0	100.0
Total	**812**	**100.0**	**100.0**	

In terms of gender, Table 6.1 illustrates that there were 812 responses to the survey. The majority of the staff members in 53 secondary schools in the Western Cape central metropole are females who represent 58% (n=471) of the sample, while males represent only 42% (n=341).

6.3 Description of age

Table 6.2 below provides an illustration of the age of secondary school educators.

Table 6.2 Descriptive statistics for the age of secondary school educators

Age	Frequency	Percent	Valid Percent	Cumulative Percent
20 – 29 yrs	97	11.9	11.9	11.9
30 – 39 yrs	191	23.5	23.5	35.5
40 – 49 yrs	320	39.4	39.4	74.9
50 – 59 yrs	173	21.3	21.3	96.2
60 yrs and above	31	3.8	3.8	100.0
Total	**812**	**100.0**	**100.0**	

The age category was categorised across five dimensions, which made it difficult to compute any meaningful statistical analysis. Most of the respondents to the survey were in the forty-year age group, followed by those in the thirty-year age group

After much consideration, the categories were collapsed into three groups on which a more meaningful analysis could be carried out. Table 6.3 illustrates the re-coded age groups.

Table 6.3 Descriptive statistics for re-coded age of educators

Recoded Age	Frequency	Percent	Valid Percent	Cumulative Percent
20-39 Years	288	35.5	35.5	35.5
40-49 Years	320	39.4	39.4	74.9
50 and above	204	25.1	25.1	100.0
Total	**812**	**100.0**	**100.0**	

As illustrated in Table 6.3, the majority of secondary school educators (39.4%) fall into the 40-49 year-age group. The 20-30 year-age group constitutes 35.5% of the sample and 25.1% is made up by the 50-year and above age group.

This analysis determined that two age groups (20-39 and 40-49) provided the highest level of representation in the sample.

6.4 Description of educational qualifications

The descriptive statistics for the Western Cape central metropole secondary school educators' highest qualifications are illustrated in Table 6.4.

Table 6.4 Descriptive statistics for educator's highest qualification

Qualification	Frequency	Percent	Valid Percent	Cumulative Percent
Certificate	19	2.3	2.3	2.3
Diploma	237	29.2	29.2	31.5
Bachelor's degree	484	59.6	59.6	91.1
Master's degree	51	6.3	6.3	97.4
Other	21	2.6	2.6	100.0
Total	**812**	**100.0**	**100.0**	

As depicted in Table 6.4, the description of the educators' highest qualification reveals that 2.3% of educators have certificates (n=19), while 29.2% of the educators have a teaching diploma (n=237), and 59.6% of the educators have a Bachelor's degree (n=484). Only 6.3% of the educators have a Master's degree (n=51), and a mere 2.6% of the educators have some other form of teaching qualification (n=21).

These statistics are indicative of the fact that the majority of educators in this sample have Bachelor's degrees.

6.5 Description of teaching experience

The descriptive statistics for the Western Cape central metropole secondary school educators' teaching experience are illustrated in Table 6.5.

Table 6.5 Descriptive statistics for educators' teaching experience

Teaching experience	Frequency	Percent	Valid Percent	Cumulative Percent
1 - 5	165	20.3	20.3	20.3
6 - 10	137	16.9	16.9	37.2
11 - 15	117	14.4	14.4	51.6
16 - 20	123	15.1	15.1	66.7
21 years or more	270	33.3	33.3	100.0
Total	**812**	**100.0**	**100.0**	

As depicted in Table 6.5, the description of the educators' teaching experience reveals that 14.4% of the educators have been teaching between 11-15 years (n=117), while 33.3% of the educators have been teaching for over 21 years and more (n=270). These statistics illustrate that the majority of secondary school educators in the Western Cape central metropole have been in the teaching profession for more than 21 years.

6.6 Description of educators' years of experience using computers

The descriptive statistics regarding the Western Cape central metropole educators' computer usage in teaching are illustrated in Table 6.6.

Table 6.6 Descriptive statistics for educators' computer use in teaching

Computer experience	Frequency	Percent	Valid Percent	Cumulative Percent
Less than 1	178	21.9	21.9	21.9
1 - 3	243	29.9	29.9	51.8
4 - 6	205	25.2	25.2	77.1
7 - 10	98	12.1	12.1	89.2
11 years or more	88	10.8	10.8	100.0
Total	**812**	**100.0**	**100.0**	

As depicted in Table 6.6, the description for educators using computers in their instruction reveals that 21.9% of these educators have less than one year of experience in using computers (n=178), while 29.9% of these educators have 1-3 years' experience using computers (n=243), and 25.2% of the educators have 4-6 years' experience using computers (n=205).

A further 12.1% of these educators have 7-10 years' experience using computers (n=98); and there are 10.8% of these educators with over 11 years of experience using computers (n=88).

These statistics illustrate that 55.1% of the secondary school educators have used computers in their instruction for 1-6 years (n=448).

6.7 Description of educators' instructional method

The descriptive statistics regarding the Western Cape central metropole educators' instructional method used in the classroom are illustrated in Table 6.7.

Table 6.7 Descriptive statistics for educators' instructional method

Instructional method	Frequency	Percent	Valid Percent	Cumulative Percent
Largely teacher-directed (e.g., teacher-led discussion, lecture)	155	19.1	19.1	19.1
More teacher-directed than student-centred(e.g., co-operative learning, discovery learning)	225	27.7	27.7	46.8
Even-balance between teacher-directed and student-centred activities	**338**	41.6	41.6	88.4
More student-centred than teacher-directed	58	7.1	7.1	95.6
Largely student-centred	36	4.4	4.4	100.0
Total	**812**	**100.0**	**100.0**	

As depicted in Table 6.7, the description for the educators' instructional method reveals that 19.1% of the educators used a largely teacher-directed discussion in their classroom (n=155), while 27.7% of these educators used a more teacher-directed than student-centred learning strategy in the classroom (n=225), and 41.6% of the educators had an even-balance between being teacher-directed and student-centred in their activities (n=338).

Only 7.1% of these educators employed a more student-centred than teacher-directed teaching style (n=58). Finally, a mere 4.4% of the educators used a largely student-centred teaching method to conduct lessons in their classroom (n=36).

These statistics indicate that educators employed an even-balance between being teacher-directed and student-centred in their instructional method in this sample.

6.8 Description of educators' level of computer usage

The descriptive statistics regarding the Western Cape central metropole educators' level of computer usage in the classroom are illustrated in Table 6.8.

Table 6.8 Descriptive statistics for educators' level of computer usage

Level of computer usage	Frequency	Percent	Valid Percent	Cumulative Percent
Unfamiliar	11	1.4	1.4	1.4
Newcomer	51	6.3	6.3	7.6
Beginner	123	15.1	15.1	22.8
Average	403	49.6	49.6	72.4
Advanced	192	23.6	23.6	96.1
Expert	32	3.9	3.9	100.0
Total	**812**	**100.0**	**100.0**	

As depicted in Table 6.8, the description of the educators' level of computer usage reveals that a mere 1.4% of the educators had had no experience with computer technologies (n=11), while 6.3% of these educators had attempted to use computer technologies, but still required help on a regular basis (n=51).

Only 15.1% of these educators were able to perform basic functions in a limited number of computer applications (n=123); and 49.6% of these educators could demonstrate a general competency in a number of computer applications (n=403). Only 23.6% of the educators had acquired the ability to competently use a broad spectrum of computer technologies; and finally, 3.9% of these educators were extremely proficient in using a wide variety of computer technologies.

These statistics indicate that most educators in the Western Cape central metropole could demonstrate a general competency in a number of computer applications.

6.9 Description of educators' computer training

The descriptive statistics regarding the Western Cape central metropole educators' computer training are illustrated in Table 6.9.

Table 6.9 Descriptive statistics for educators' computer training

Computer training	Frequency	Percent	Valid Percent	Cumulative Percent
Yes	738	90.9	90.9	90.9
No	74	9.1	9.1	100.0
Total	**812**	**100.0**	**100.0**	

As depicted in Table 6.9, the description of the educators' computer training reveals that 90.9% of these educators had received some form of computer training (n=738), while 9.1% of these educators had received no training at all (n=74).

Most of the educators who did not participate or receive training complained about the time at which the training was scheduled, which in many cases was after school hours. A few mentioned that the training personnel were not sufficiently well trained themselves to deliver training material. Some educators were concerned that the training that was offered was too advanced for them; and it was assumed that all educators needed to be at that advanced level.

Educators who had been teaching for 20 years and more reported that they had no faith in computers and that these technologies demanded a large amount of their time in getting educational programs to work efficiently.

This section concludes the general descriptive statistics for the present study. Next follows the descriptive statistics related the educators' computer utilisation in the classroom.

6.10 Computer utilisation

Table 6.10 represents the frequency of educator computer utilisation, namely: the dependent variable.

Table 6.10 Frequency of educators' computer utilisation

Educator computer utilisation	Scores in percentage				
	No knowledge	Limited knowledge	Sufficient for basic tasks	Adequate for most tasks	Competent and knowledge-able
Start and shut down the computer correctly	1.6	1.4	5.4	42.4	49.3
Swapping between applications	11.7	4.3	8.5	11.7	**73.8**
Retrieve files from stiffy disks, flash drives and cd-roms	3.1	6.3	15.4	22.3	53
Copy, delete and rename files	3	5.5	12.6	17.4	61.6
Understand how a word processor can be used	3.4	7.9	16.1	19.8	52.7
Use a word processor in lessons	8.5	13.5	17.6	20.7	39.7
Understand how graphics software can be used	14.3	20.2	24.1	17	24.4
Use a graphics package to prepare teaching materials	16	26.4	23.8	14.4	19.5
Understand how a spreadsheet can be used	8	14.8	22.8	22.8	31.7
Use a spreadsheet to prepare teaching materials	11.2	19.2	23.9	20.2	25.5

Educator computer utilisation	Scores in percentage				
	No knowledge	Limited knowledge	Sufficient for basic tasks	Adequate for most tasks	Competent and knowledge-able
Understand how a database can be used	13.9	24.1	26.6	16.1	19.2
Use databases in lessons	18.3	28	25	15	13.7
Use content specific software in lessons	15.4	21.3	24.9	20.2	18.2
Understand how the World Wide Web (www) can be used	8.6	13.1	19.6	22.5	36.2
Use the World Wide Web to support your teaching	11	15	19.8	20.1	34.1
Understand how e-mails can be used	5.4	9.4	17.4	22.8	45.1
Participate in "real-time" discussions, e.g., in a chat room	**26.4**	23.9	17.5	11.9	20.3
Understand how to use a proxima	22.9	21.4	18.3	12.1	25.2

As depicted in Table 6.10, the most frequent procedure that educators are proficient at is swapping between applications (73.8%) and copying, renaming and the deletions of files (61.6%). What is encouraging to observe is that most educators (42.1% "adequate" and 49.3% "competent") had confidence in starting and shutting down the computer correctly. It is reasonable to assume that 26.4% educators did not participate in "real-time discussions" and made the least use of computers in their teaching because of insufficient time during normal school hours.

The moderate scores in the 'competent and knowledgeable' column of Table 6.10 suggest that educators do possess the relevant skills in computer use, such as e-mailing, internet searches and spreadsheets.

6.11 Theories and beliefs

The descriptive statistics regarding educators' theories and beliefs are depicted in Table 6.11.

Table 6.11 Frequency of educators' theories and beliefs

Educators' theories and beliefs	Scores in percentage				
	Strongly disagree	Dis-agree	Un-decided	Agree	Strongly agree
Using computers has changed the way in which I relate to the learners	9.0	12.1	21.2	42.1	15.6
My biggest fear in using computers in the class is embarrassment in front of my learners	**42**	32.8	9.2	12.2	3.8
My biggest fear in using computers during lessons is losing control of the class	36.8	34.5	10	14.8	3.9
I sometimes feel that I have been left behind when it comes to using computers	23.8	34.7	8.9	28.2	4.4
I am afraid that if I begin to use computers I will become dependent on them and lose some of my reasoning skills	39.7	**43**	7.8	6.9	2.7
Schools cannot expect us to learn all these new computer technologies without giving us extra pay	20.6	28.9	17	24.5	9
I have made progress during the past year in learning new computer skills	2.1	7.5	8.4	**59.6**	22.4
Teaching with computers offers real advantages over traditional methods of instruction	1.8	5.7	12.2	51.7	28.6
Using computer technology in the classroom would make the subject matter interesting	2.2	3.9	7.3	48.5	38.1
It would be hard for me to learn to use the computer in teaching	41.9	42.1	7.4	6.8	1.8
Computers complicate my task in the classroom	35.7	42.2	11.6	7.6	2.8

Educators' theories and beliefs	Scores in percentage				
	Strongly disagree	Dis-agree	Un-decided	Agree	Strongly agree
Using computers makes preparation for lessons time-consuming	22.9	33.3	16	21.4	6.4
Using computers in school makes the academic environment intellectually stimulating	1.6	3.1	10.6	56	28.7
Using computers in school makes my administration more efficient	1.7	3.2	7.6	45.4	**42**
Computers have often disrupted my lessons due to problems with hardware	11.5	26.2	33.5	24.9	3.9
Computers have often disrupted my lessons due to problems with software	10.1	28	32.5	26.1	3.3
Using computers results in learners neglecting important traditional learning resources (e.g., library books)	7.3	22.3	20.3	36.8	13.3
Using computers in teaching is difficult because some learners know more about computers than educators	14.4	36.8	20.2	3.6	5.2
Computers could reduce the number of educators employed in the future	26.6	38.4	18.1	12.9	3.9
Using computers gives educators the opportunity to be learning facilitators, instead of information providers	2.6	8.5	15.1	55	18.7
I am excited about using computers in my work as an educator	1.5	3.3	12.6	50.5	32.1

As depicted in Table 6.11, the most frequent observation of educators' theories and beliefs was "using computers in school makes my administration efficient" (42%); this is followed by "I have made progress during the past year in learning new computer skills" (59.6%). The most frequent observation on which educators strongly disagreed was "my biggest fear in using computers in the class is embarrassment in front of my learners" (42%), followed by "I am afraid that if I begin to use computers I will become dependent upon them and lose some of my reasoning skills" (43%).

These descriptive statistics suggest that educators do not feel threatened by students who are skilled computer users, and that they will use computers during their lessons in the classroom.

6.12 Access to computers

The descriptive statistics regarding educators' access to computers are depicted in Table 6.12.

Table 6.12 Frequency of educators' access to computers

Access frequency	Scores in percentage				
	Never	**Rarely**	**Sometimes**	**Often**	**Very Often**
A computer at your workspace in school with educational software installed for teaching purposes	15.3	13.3	22	22.4	27
Technological equipment (e.g. scanners, proximas, whiteboards, printers) in your classroom for teaching purposes	**50.1**	**15.8**	13.7	9.5	11
A computer lab	6.3	9.7	25.6	**27.5**	30.9
A computer in your home	9.9	3.8	7.3	19	**60.1**
A computer in a media centre	29.6	12.9	19	17.5	21.1
A computer in a library	38.2	14.8	15.4	13.9	17.7

Educators were asked 'how often they had access to computers'. As depicted in Table 6.12, most of the educators had access to computers at home (60.1%), and often in a computer lab at school (27.5%).

The most frequent lack of access was to technological equipment such as scanners, proximas, whiteboards and printers (never=50.1% and rarely=15.8%). These statistics suggest that educators have access to computers "very often" at home and "often" in a computer lab. However, a few educators (6.3%) indicated that they never had access to a computer lab.

The descriptive statistics regarding educators' limited access to computers are depicted in Table 6.13.

Table 6.13 Frequency of educators' limitation of access to computers

Access limitation	Scores in percentage				
	Never	Rarely	Sometimes	Often	Very Often
Not enough computers at school	21.6	14.7	23	20.9	19.8
Insufficient software licenses at school	**33.5**	19.7	21.6	15.8	9.5
Obsolete computer equipment, which cannot be used for classroom instruction	27.5	21.6	21.8	16.5	12.7
The network is frequently down or unavailable	9.7	23.4	38.5	17.4	11
Vandalism of computer equipment in school	**33.5**	**34.5**	18.7	8.1	5.2
Internet access which is not easily accessible at school	19.7	23.9	31.3	15.1	10
Limited classrooms that are suitable for computer equipment	15.3	16.9	17.4	**24.1**	**26.4**

Continuing the discussion of access to computers, educators were asked which statements limited their access to computer usage. As depicted in Table 6.13, the two most frequent factors limiting the educators' access to computers was the fact that classrooms were frequently unsuitable for computer equipment (very often=26.4% and often=24.1%).

The most frequent reason for a lack of access to computers was the vandalism of computer equipment (34.5%) and insufficient computer program licences (33.5%). These statistics suggest that when educators do not have access to computers, this could be attributed to vandalism of computer equipment and insufficient computer program licences.

6.13 Perceived attitudes

The descriptive statistics regarding educators' attitudes towards computers are depicted in Table 6.14.

Table 6.14 Frequency of educators' perceived attitudes towards computers

Educators' attitude	Scores in percentage				
	Strongly disagree	Dis-agree	Un-decided	Agree	Strongly agree
Computers do not scare me at all	3.8	6.4	6.9	39.3	43.6
Computers are a fast means of getting information	.6	.9	1.2	40.1	**57.1**
I prefer to deliver lessons using computers	2.6	13.8	34.1	31.2	18.3
I think that working with computers could be stimulating	.4	1.5	10.8	**58.7**	28.6
The challenge of learning about computers is exciting	1.5	2.6	8.6	55.2	32.1
Computers do more harm than good	32.5	41.3	17	7	2.2
I dislike using computers in teaching	35.6	42.7	14.4	4.8	2.5
I have no intention of using computers for teaching in the near future	47.3	37.9	8.1	4.1	2.6
Using a computer is very frustrating	38.7	41	12.6	7.1	.6
I will probably never learn to use a computer	**70.3**	24.3	3.3	1	1.1
The use of computers in education reduces the personal treatment of learners	23.5	41.3	17.5	14.9	3.1
Working with computers makes me feel isolated from other people	30.4	**44.6**	12.1	10.7	2.2
Computers can help me learn	1.6	2.1	2.8	52.6	40.9
The challenge of solving problems with computers does not appeal to me	24.9	44	16.9	11.2	3.1
Computers are necessary tools in educational settings	1.1	3.3	4.8	48.8	42
Computers have the potential to control our lives	12.7	28.4	20.9	28.7	9.2

Educators’ attitude	Scores in percentage				
	Strongly disagree	Dis-agree	Un-decided	Agree	Strongly agree
I see the computer as something I will rarely use in my daily life	43.1	41.4	4.8	7.3	3.4
Working with a computer makes me nervous	48.2	36.9	4.9	6.7	3.3

As depicted in Table 6.14, the most frequent positive attitude found towards computers was in those educators (57.1%) who strongly agreed that computers are a fast means of getting information; and in 58.7% who agreed that working with computers could be stimulating.

The most frequent negative attitude towards computers should be interpreted with caution, because the statement with the most frequent score is negatively worded. Hence, an educator strongly disagreeing and not wanting to learn how to use a computer (70.3%) could actually mean that they want to learn how to use a computer. The same interpretation applies to educators who disagreed when working with computers - it makes them nervous (44.6%).

These statistics suggest that educators have a slightly positive attitude towards computers as a device to conduct their lessons in the classroom.

6.14 Support

The descriptive statistics regarding educators’ support towards computers are depicted in Table 6.15.

Table 6.15 Frequency of educators' support

Educators' support	Scores in percentage				
	Strongly disagree	Disagree	Un-decided	Agree	Strongly agree
The administration provides consistent computer support to educators	10	21.4	14.2	40.6	13.8
The administration provides an on-site computer technician to assist educators in computer use	**18.5**	28	8.3	28	17.4
My colleagues assist me with computer-related issues	3.4	6.4	7.1	**64.4**	18.6
My colleagues encourage me to use computers	3	8.7	10.8	59.4	18.1
The people who give me the best ideas for improving my teaching also tend to know a lot about using computers	3.7	13.5	20.1	44	**18.7**
There is a general lack of support to integrate the use of computers into the curriculum	10.1	23.9	18.1	35	12.9
There is sufficient support among educators using web-based programs	9.5	27.2	28.1	28.9	6.3
There is a lack of technical computer support in my school	16.4	**33.1**	14.3	26.6	9.6
There is sufficient support through training in my school	8.4	29.4	20.6	33	8.6
There is sufficient support through educational courses in my school	9.1	32.3	22.7	29.9	6

As depicted in Table 6.15, the most frequent support educators receive is described as follows: "the people who give me the best ideas for improving my teaching also tend to know a lot about using computers" (18.7%); and "my colleagues assist me with computer related issues" (64.4%).

The most frequent lack of support response was "the administration provides an on-site computer technician to assist educators in computer use" (18.5%), and "there is a lack of technical computer support in my school" (33.1%). These statistics suggest that educators have sufficient support when using computers in teaching.

6.15 Training

The descriptive statistics regarding the consequence of educator computer training are depicted in Table 6.16.

Table 6.16 Frequency of educators' perceived consequence of training

Educator training – consequence	Scores in percentage				
	Strongly disagree	Disagree	Un-decided	Agree	Strongly agree
The training I have received has: Enhanced my computer skills	0.7	3.6	3.6	57.1	**28.9**
The training I have received has: Allowed me to have useful discussions with other professionals	1.2	10.2	17.1	49.6	15.8
The training I have received has: Given me a greater awareness of teaching materials	1.1	8	9.6	**58.7**	16.5
The training I have received has: Provided me with ideas for using computers in lessons	1.5	8.6	12.1	55.7	16.1
The training I have received has: Allowed me to reflect on my classroom practice	1.2	11.7	17.9	49.9	13.3
The training I have received has: Helped me to change my teaching practice	**2.2**	**15.1**	19.3	43.6	13.7
Helped me to integrate the use of computers into my teaching practice	2.7	14	16.1	46.7	14.4
Enhanced my knowledge of good practice for using computers in lessons	1.8	12.8	16.4	48.3	14.7
Provided me with insights to improve future staff-training programs	2.2	14	25	40.8	11.9

As depicted in Table 6.16, the most frequent factors relating to the consequence of training were training that "enhanced the educators' computer skills" (28.9%) and training that has provided the educator with a "greater awareness of teaching materials" (58.7%). The most frequent response regarding disagreement with the consequence of educator training was training that helped change the educator's teaching practice (17.3%, "strongly disagreed" and "disagreed"). These descriptive statistics suggest that the consequence of training has a positive effect on the educators' teaching skills.

The descriptive statistics regarding the value of educator computer training are depicted in Table 6.17.

Table 6.17 Frequency of educators' perceived value of training

Educator training - value	Scores in percentage				
	No value	Low value	Medium value	High value	Very high value
Training that covers basic computer skills	**6.3**	**12.1**	25.2	30.3	26.1
Training that covers advanced computer skills	1.4	5	21.3	**45.7**	26.6
Training that provides ideas for using computers in my subject teaching	.9	3.1	14.7	39.5	**41.9**
Training that address my continuous professional development in computers	1	4.9	17.6	42.2	34.2
Training skills that enhance the use of computers for administration	.7	4.6	16.5	40.3	37.9
Training that provides information on how to integrate computers into the curriculum	1.2	4.7	15.9	42.7	35.5

As depicted in Table 6.17, the most frequent factors relating to the value of educator training were training that provided "ideas for using computers in a particular subject" (41.9%) and training that "covers advanced computer skills" (45.7%).

Training that added no value to the needs of the educators was training that "covered basic computer skills" (18.4%).

This descriptive statistic suggests that educators are cognisant of the value of training. The descriptive statistics regarding the importance of educator computer training are depicted in Table 6.18.

Table 6.18 Frequency of educators' perceived importance of training

Educator training - importance	Scores in percentage				
	Not all important	Not very important	Important	Very important	Extremely important
In-house computer training	4.8	7.1	38.8	27.2	19
Computer training programs conducted by an external consultant at school	**5.2**	**10.5**	34.6	30.2	16.5
Training that has given me confidence in using computers	1.7	5.7	29.1	37.2	23.3
Training which helps me to analyse information	2.1	8.9	32	**34.2**	19.7
Training which assists me to communicate with colleagues using e-mail	4.2	8.6	27.1	31	26
One-on-one computer training, specific to the subject you are teaching	3.6	8.3	26.1	29.1	**29.9**

As depicted in Table 6.18, the most frequent factors relating to the importance of training were "one-on-one computer training" (29.9%) and training which assisted the educator to "analyse information" (34.2%).

The most frequent observation on training which was seen as not being important was training "conducted by an external consultant at school" (15.7%).

These descriptive statistics suggest that educators are in agreement regarding the importance of computer training.

6.16 Pedagogy

The descriptive statistics on the importance of educator pedagogy are depicted in Table 6.19.

Table 6.19 Frequency of the importance of educators' pedagogy

Educator pedagogy - importance	Scores in percentage				
	Not all important	Not very important	Important	Very important	Extremely important
Computers are used: To enhance pupils' communication skills	**4.2**	**13.4**	36.9	29.1	16.4
Computers are used: To search for information	0.1	1.2	20.6	39.9	**38.2**
Computers are used: To promote independent learning	0.5	3.9	26.8	41.1	27.6
Computers are used: To develop problem-solving skills	0.9	6.2	27.2	37.8	28
Computers are used: To produce work more efficiently	0.2	2.7	24.1	**41.7**	31.2
Computers are used: To experiment with new teaching styles	1.4	4.8	32.3	38.2	23.4
Computers are used: To reflect more on my teaching practice	2.3	8.9	34.5	35.8	18.5

As depicted in Table 6.19, the most frequent factors relating to the importance of educator pedagogy were when "computers were used to search for information" (38.2%) and when computers were used "to produce work more efficiently" (41.7%).

The most frequent observation on educator pedagogy that was considered not to be important was when computers are used "to enhance pupils' communication skills" (17.6%). These descriptive statistics suggest that educators are relying on computers to enhance their methods of teaching knowledge to pupils.

The descriptive statistics regarding the confidence of educator pedagogy are depicted in Table 6.20.

Table 6.20 Frequency of confidence in educators' pedagogy

Educator pedagogy - confidence	Scores in percentage				
	Not at all knowledge-able	Not very knowledge-able	Knowledge-able	Very knowledge-able	Extremely knowledgeable
Demonstrate aspects of a topic in your subject through the use of computers	5.5	22.4	42.4	19.1	10.6
Select appropriate software for the teaching of particular subjects	**9.7**	**32.8**	35.8	15.8	6.5
Use computers to respond to the learning requirements of the national curriculum	7.5	29.9	39.3	16.7	6.5
Incorporate information from the internet into teaching materials	5.3	20.1	37.9	**25.5**	**11.2**
Combine the use of computers with other conventional media (e.g. text books, handouts)	4.8	20.3	40.6	23.9	10.3

Educator pedagogy - confidence	Scores in percentage				
	Not at all knowledge-able	Not very knowledge-able	Knowledge-able	Very knowledge-able	Extremely knowledgeable
Judge the effectiveness of using computers in achieving teaching objectives	6.8	30	38.8	18	6.4
Know how computers can be used in your specialist subject	6.3	25.7	40.6	17.7	9.6
Know how computers can support your continuing professional development	5.9	26.7	38.9	20	8.5

As depicted in Table 6.20, the most frequent factor relating to the confidence of educator pedagogy was the incorporation of "information from the internet into teaching materials" (36.7%). The most frequent observation on having no confidence or lacking in knowledge was on how to "select the appropriate software for teaching specific subjects" (42.5%).

These descriptive statistics suggest that when educators do not have the ability to select the appropriate software for the subjects they teach, they attribute it to not being knowledgeable about the computer programs intended for educational purposes.

The descriptive statistics regarding the productivity of educator pedagogy are depicted in Table 6.21.

Table 6.21 Frequency of productivity (educators' pedagogy)

Educator pedagogy - productivity	Scores in percentage				
	Strongly disagree	Disagree	Undecided	Agree	Strongly Agree
It is important for pupils to learn about computers in order to be informed citizens	0.4	1.1	3.6	47.4	**47.5**
Computers increase my productivity	0.9	2.8	11	51.8	33.5
Computers can be useful instructional aids in all subject areas	0.1	1.2	6.4	**54.3**	37.9
Computers will improve education	0.6	1.5	10	50.7	37.2
Computers stimulate creativity in learners	**1.2**	**3.4**	13.9	48.2	33.3

As depicted in Table 6.21, the most frequent factors relating to the productivity of educator pedagogy were the importance of "pupils to learn about computers in order to become informed citizens" (47.5%), and the fact that computers are "useful instructional aids in all subject areas" (54.3%).

The most frequent observation on having no productivity in educator pedagogy is when 4.6% educators disagreed that "computers can stimulate creativity in learners". This descriptive statistic suggests that educators are using computers in their instruction to increase their productivity in the classroom.

Next follows a discussion on regression and correlation analysis that was computed for this study.

6.17 Regression and correlation analysis

This study included a relatively large number of variables whose influence needed to be measured. A series of stepwise regressions was done to investigate the predictive power of the dependent variable.

Stepwise regression searches for predictor variables that adequately predict responses to a dependent variable by linear or non-linear regression.

The procedure involves analysing the correlation between the dependent and independent variables, and including, one-by-one, those independent variables that best explain the variation in the dependent variable, into the regression model (Field, 2005).

The excluded variables are appended as Appendix F. Table 6.22 illustrates the stepwise regression model.

Table 6.22 Model summary of the three independent variables

Model Summary					
Model	**Variables Entered**	**R**	**R Square**	**Adjusted R Square**	**Std. Error of the Estimate**
1	Educator Pedagogy (Total)	0.477[a]	0.227	0.226	11.67512
2	Educator Theories and Beliefs (Total)	0.553[b]	0.306	0.304	11.07389
3	Access (Total)	0.573[c]	**0.329**	0.326	10.89686
a. Predictors: (Constant), Educator Pedagogy (Total)					
b. Predictors: (Constant), Educator Pedagogy (Total), Educator Theories and Beliefs (Total)					
c. Predictors: (Constant), Educator Pedagogy (Total), Educator Theories and Beliefs (Total), Access (Total)					

As illustrated in Table 6.22, the highest predictor to the dependent variable is educator pedagogy, followed by educator theories and beliefs, and lastly access to computers.

It is evident from the table that the three independent variables from the initial six independent variables provided the highest level of statistical significance to our understanding of the dependent variable.

Table 6.23 ANOVA results for three independent variables

ANOVA						
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	30289.022	1	30289.022	222.209	0.000[a]
	Residual	103049.226	756	136.309		
	Total	133338.248	757			
2	Regression	40751.850	2	20375.925	166.156	0.000[b]
	Residual	92586.398	755	122.631		
	Total	133338.248	757			
3	Regression	43807.094	3	14602.365	122.976	**0.000**[c]
	Residual	89531.154	754	118.742		
	Total	133338.248	757			

a. Predictors: (Constant), Educator Pedagogy (Total)

b. Predictors: (Constant), Educator Pedagogy (Total), Educator Theories and Beliefs (Total)

c. Predictors: (Constant), Educator Pedagogy (Total), Educator Theories and Beliefs (Total), Access (Total)

Table 6.24 Beta coefficients for the three independent variables

Coefficients[a]						
Model		Unstandardized Coefficients		Standardized Coefficients	T	Sig.
		B	Std. Error	Beta		
3	(Constant)	32.093	4.616		6.952	0.000
	Educator Pedagogy	0.357	0.039	0.311	9.227	0.000
	Educator Theories and Beliefs	-0.402	0.043	-0.310	-9.332	0.000
	Access (Total)	0.308	0.061	0.154	5.072	**0.000**

a. Dependent Variable: Educator use of Computers

From Table 6.22, Table 6.23 and Table 6.24, it is evident that educator theories and beliefs, educator pedagogy and access to computers, are all significant predictors of computer utilisation for teaching (the dependent variable). It is clear that this model is significant and accounts for 32.9% of the variance in the dependent variable.

In Chapter Five the Exploratory Factor Analysis (EFA) results suggested that some of the variables could have two-factor solutions that could measure computer utilisation by secondary school educators in the classroom (i.e. the dependent variable).

The tables below (6.25 to 6.27) explain the sub-dimensions contained in each of the independent variables and provide an explanation to assist our understanding of the dependent variable.

Excluded variables are appended as Appendix F.

Table 6.25 Multiple-regression model summary of independent variable sub-dimensions

Model Summary					
Model	**Variables Entered**	**R**	**R Square**	**Adjusted R Square**	**Std. Error of the Estimate**
1	Educator Pedagogy (Confidence)	0.613[a]	0.376	0.375	10.48913
2	Negative Theories and Beliefs	0.664[b]	0.441	0.440	9.93477
3	Frequency of Access To Computers	0.679[c]	0.461	0.458	9.76715
4	Educator Support (Administration Support)	0.689[d]	0.474	0.471	9.64960
5	Consequences of Using Computers	0.696[e]	0.484	0.481	9.56384
6	Educator Pedagogy (Importance)	0.702[f]	0.492	0.488	9.49327
7	Positive Attitude Towards Computers	0.707[g]	0.500	0.496	9.42376
8	Educator Pedagogy (Productivity)	0.712[h]	**0.506**	0.501	9.37503
a. Predictors: (Constant), Educator Pedagogy (Confidence)					
b. Predictors: (Constant), Educator Pedagogy (Confidence), Negative Theories and Beliefs					
c. Predictors: (Constant), Educator Pedagogy (Confidence), Negative Theories and Beliefs, Frequency of Access					

Model Summary					
Model	Variables Entered	R	R Square	Adjusted R Square	Std. Error of the Estimate

d. Predictors: (Constant), Educator Pedagogy (Confidence), Negative Theories and Beliefs, Frequency of Access to Computers, Educator Support Using Computers (Administration Support)

e. Predictors: (Constant), Educator Pedagogy (Confidence), Negative Theories and Beliefs, Frequency of Access to Computers , Educator Support Using Computers (Administration Support), Consequences of Using Computers

f. Predictors: (Constant), Educator Pedagogy (Confidence), Negative Theories and Beliefs, Frequency of Access to Computers, Educator Support Using Computers (Administration Support), Consequences of Using Computers , Educator Pedagogy (Importance)

g. Predictors: (Constant), Educator Pedagogy (Confidence), Negative Theories and Beliefs, Frequency of Access to Computers, Educator Support Using Computers (Administration Support), Consequences of Using Computers , Educator Pedagogy (Importance), Positive Attitude Towards Computers

h. Predictors: (Constant), Educator Pedagogy (Confidence), Negative Theories and Beliefs, Frequency of Access To Computers , Educator Support Using Computers (Administration Support), Consequences of Using Computers , Educator Pedagogy (Importance), Positive Attitude Towards Computers, Educator Pedagogy (Productivity)

Dependent Variable: Educator use of Computers

Table 6.26 ANOVA results for the six independent variables based on the (sub-dimensions)

ANOVA						
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	50161.673	1	50161.673	455.924	0.000[a]
	Residual	83176.575	756	110.022		
	Total	133338.248	757			
2	Regression	58819.949	2	29409.975	297.974	0.000[b]
	Residual	74518.299	755	98.700		
	Total	133338.248	757			

ANOVA						
Model		Sum of Squares	df	Mean Square	F	Sig.
3	Regression	61408.768	3	20469.589	214.572	0.000[c]
	Residual	71929.480	754	95.397		
	Total	133338.248	757			
4	Regression	63222.818	4	15805.705	169.744	0.000[d]
	Residual	70115.430	753	93.115		
	Total	133338.248	757			
5	Regression	64555.050	5	12911.010	141.155	0.000[e]
	Residual	68783.198	752	91.467		
	Total	133338.248	757			
6	Regression	65656.458	6	10942.743	121.421	0.000[f]
	Residual	67681.790	751	90.122		
	Total	133338.248	757			
7	Regression	66732.808	7	9533.258	107.348	0.000[g]
	Residual	66605.440	750	88.807		
	Total	133338.248	757			
8	Regression	67507.743	8	8438.468	96.010	**0.000[h]**
	Residual	65830.505	749	87.891		
	Total	133338.248	757			

The description of (a-h) in the significance column is the same as in table 6.25. The full multiple regression report is appended as Appendix J.

Table 6.27 Beta coefficients for six independent variables sub-dimensions

Coefficients[a]						
Model		Unstandardised Coefficients		Standardised Coefficients	t	Sig.
		B	Std. Error	Beta		
8	(Constant)	53.104	5.040		10.537	0.000
	Educator Pedagogy (Confidence)	0.869	0.058	0.464	14.999	0.000
	Negative Theories and Beliefs	-0.349	0.048	-0.210	-7.304	0.000
	Frequency of Access To Computers	0.447	0.072	0.180	6.236	0.000
	Educator Support Using Computers (Administration Support)	-0.363	0.078	-0.131	-4.653	0.000
	Consequences of Using Computers	0.254	0.065	0.126	3.911	0.000
	Educator Pedagogy (Importance)	-0.235	0.086	-0.088	-2.727	0.007
	Positive Attitude Towards Computers	-0.512	0.120	-0.147	-4.248	0.000
	Educator Pedagogy (Productivity)	-0.476	0.160	-0.103	-2.969	**0.003**

a. Dependent Variable: Educator use of computers

Table 6.25, Table 6.26 and Table 6.27 present the finer details of all the sub-dimensions of the independent variables.

It is evident that the confidence in educator pedagogy, negative theories and beliefs, frequency of access to computers, administration support to educators, the consequence of using computers, the importance of educator pedagogy, positive attitudes towards computers and the productivity of educator pedagogy are all significant predictors for the use of computers for teaching (the dependent variable).

It is clear that when all of the sub-dimensions are computed, this model is more significant and now accounts for 50.6% of the variance in the dependent variable.

The above section has provided a broad overview of which factors are contributing to our understanding of the independent variable and has illustrated that the various models are statistically significant.

6.18 Inferential statistical analysis

The following section focuses on the One-Way ANOVA, Correlations and Post Hoc Multiple Comparison tests that were used in this study. ANOVA can only identity whether there are any significant differences in groups by the indication of a large "F" statistic. However, ANOVA is unable to identify which groups differ from each other (Field, 2005). In addition, ANOVA cannot identify where the differences are and how many differences there are in terms of magnitude.

Hence, the Post Hoc test is used to overcome these shortcomings. Post Hoc tests involve comparing the means of all combination pairs. The One-Way Anova statistic relationships for the dimension age are illustrated in Table 6.28. Only significant differences are reported in the following section.

6.18.1 Age

Table 6.28 ANOVA between six independent variables and age

ANOVA – Age						
		Sum of Squares	**df**	**Mean Square**	**F**	**Sig.**
Educator Theories and Beliefs (Total)	Between Groups	1520.585	2	760.293	7.390	**0.001**
	Within Groups	83230.059	809	102.880		
	Total	84750.644	811			
Frequency of Access To Computers (Total)	Between Groups	117.781	2	58.890	2.024	0.133
	Within Groups	23542.820	809	29.101		
	Total	23660.601	811			

ANOVA – Age						
		Sum of Squares	**df**	**Mean Square**	**F**	**Sig.**
Problems Associated With Access To Computers (Total)	Between Groups	285.676	2	142.838	3.679	**0.026**
	Within Groups	31405.737	809	38.820		
	Total	31691.413	811			
Educator's Attitude Towards Computers (Total)	Between Groups	211.112	2	105.556	5.110	**0.006**
	Within Groups	16711.883	809	20.657		
	Total	16922.995	811			
Educator Support Using Computers (2F Solution Total)	Between Groups	326.827	2	163.413	4.635	**0.010**
	Within Groups	28525.025	809	35.260		
	Total	28851.852	811			
Consequences of Using Computers (Total)	Between Groups	627.101	2	313.551	7.402	**0.001**
	Within Groups	32195.098	760	42.362		
	Total	32822.199	762			
Value of Computer Training (Total)	Between Groups	109.189	2	54.594	2.217	0.110
	Within Groups	19917.560	809	24.620		
	Total	20026.749	811			
Importance of Computer Training (Total)	Between Groups	114.293	2	57.146	2.540	0.080
	Within Groups	17638.538	784	22.498		
	Total	17752.831	786			
Educator Pedagogy (Total)	Between Groups	2648.481	2	1324.241	10.139	**0.000**
	Within Groups	105660.932	809	130.607		
	Total	108309.413	811			

ANOVA – Age						
		Sum of Squares	**df**	**Mean Square**	**F**	**Sig.**
Educator Pedagogy F1 (Importance)	Between Groups	139.445	2	69.722	2.821	0.060
	Within Groups	19996.421	809	24.717		
	Total	20135.866	811			
Educator Pedagogy_F2 (Confidence)	Between Groups	1567.634	2	783.817	16.031	**0.000**
	Within Groups	39555.430	809	48.894		
	Total	41123.064	811			
Educator Pedagogy_F3 (Productivity)	Between Groups	32.540	2	16.270	1.982	0.138
	Within Groups	6641.726	809	8.210		
	Total	6674.266	811			
Negative Attitude Towards Computers	Between Groups	331.525	2	165.763	4.646	**0.010**
	Within Groups	28861.749	809	35.676		
	Total	29193.275	811			
Positive Attitude Towards Computers	Between Groups	105.017	2	52.509	3.673	**0.026**
	Within Groups	11564.490	809	14.295		
	Total	11669.507	811			
Positive Theories and Beliefs	Between Groups	273.273	2	136.636	7.169	**0.001**
	Within Groups	15418.140	809	19.058		
	Total	15691.413	811			
Negative Theories and Beliefs	Between Groups	574.771	2	287.385	4.554	**0.011**
	Within Groups	51048.224	809	63.100		
	Total	51622.995	811			
Educator Support Using Computers_F1	Between Groups	137.567	2	68.783	3.079	**0.047**
	Within Groups	18074.230	809	22.341		

ANOVA – Age						
		Sum of Squares	df	Mean Square	F	Sig.
Administration Support)	Total	18211.797	811			
Educator Support Using Computers_F2 (Collegial Support)	Between Groups	76.135	2	38.067	7.207	**0.001**
	Within Groups	4273.337	809	5.282		
	Total	4349.472	811			
Computer use_F1 (Functionality)	Between Groups	5173.354	2	2586.677	25.843	**0.000**
	Within Groups	80974.936	809	100.093		
	Total	86148.291	811			
Computer use_F2 (Procedures)	Between Groups	951.724	2	475.862	28.947	**0.000**
	Within Groups	13299.414	809	16.439		
	Total	14251.138	811			
Computer use	Between Groups	10492.458	2	5246.229	31.453	**0.000**
	Within Groups	134936.281	809	166.794		
	Total	145428.739	811			

As illustrated in Table 6.28, there are significant differences ($p< 0.05$) between the various highlighted groups. These are indicated by the large associated “F” values. These differences are discussed with the tables below.

The following section investigates the relationships between the various independent and dependent variables, as expressed in terms of correlation coefficients.

Table 6.29 to Table 6.31 provide statistical evidence of all of the correlations that are significant.

Furthermore, significant correlations provide evidence of the Bivariate relationships in the model, illustrating the process of computer utilisation by educators in the classrooms.

Bivariate analysis tests the hypotheses of association and causality. This measure of association helps the researcher to understand how well an independent variable relates to the dependent variable.

Table 6.29 Correlations between the independent and dependent variables

Independent variable (total)	Dependent variable (2 factors)		
	Pearson correlation	Significance (2-tailed)	N
Educator pedagogy	**0.485****	0.000	812
Educator theories and beliefs	-0.464**	0.000	812
Educator attitude towards computers	-0.418**	0.000	812
Educator access to computers	0.243*	0.000	812
Educator support using computers	0.075*	0.033	812

**. Correlation is significant at the 0.01 level (2-tailed).
*. Correlation is significant at the 0.05 level (2-tailed).

It is evident from Table 6.29 that the first five of the six predictor variables are significantly related to the dependent variable namely: computer utilisation by secondary school educators for teaching instruction in the classroom.

From Table 6.29 it further seems that educator pedagogy has the strongest relationship to the dependent variable. The complete correlation report is appended as Appendix I.

Table 6.30 presents the correlations between the dependent and independent variables used in this study.

Table 6.30 Correlation between the total score of the independent variables and the dependent variable

Independent variable	Dependent variable	Pearson correlation	Sig. (2-tailed)	N
Educator theory and beliefs (total)	Function (F1)	-0.424**	0.000	812
	Procedure (F2)	**-0.440****	0.000	812
Educator attitude (total)	Function (F1)	-0.394**	0.000	812
	Procedure (F2)	-0.368**	0.000	812
Educator support (total)	Function (F1)	0.75*	0.032	812
	Procedure (F2)	0.054	0.121	812
Educator access (total)	Function (F1)	0.227**	0.000	812
	Procedure (F2)	0.217**	0.000	812
Educator pedagogy (total)	Function (F1)	**0.487****	0.000	812
	Procedure (F2)	0.352**	0.000	812

**. Correlation is significant at the 0.01 level (2-tailed).
*. Correlation is significant at the 0.05 level (2-tailed).

Table 6.30 compares the total scores between the five independent variables with the two factors in the dependent variable namely: function and procedures.

The independent variable of educator theories and beliefs has a strong negative correlation to factor two in the dependent variable, namely: procedures (r^2= -.440** $p<0.01$).

In contrast, independent variable educator pedagogy has a strong positive correlation to factor one in the dependent variable, namely: function (r^2= 0.487** $p<0.01$).

Next, Table 6.31 presents the correlations between all the sub-dimensions in the independent and dependent variables.

Table 6.31 Correlation between sub-dimensions in the independent variable and the dependent variable

Sub-dimensions in independent variables		Dependent variable
Educator beliefs: Positive		BELIEFS
Pearson Correlation	-0.296**	
Sig. (2-tailed)	0.000	
N	812	
Educator beliefs: Negative		
Pearson Correlation	-0.431**	
Sig. (2-tailed)	0.000	
N	812	
Access: Frequency		ACCESS
Pearson Correlation	0.364**	
Sig. (2-tailed)	0.000	
N	812	
Access: Problems		
Pearson Correlation	-0.055	
Sig. (2-tailed)	0.117	
N	812	
Attitudes: Positive		ATTITUDES
Pearson Correlation	-0.402**	
Sig. (2-tailed)	0.000	
N	812	
Attitudes: Negative		
Pearson Correlation	-0.406**	
Sig. (2-tailed)	0.000	
N	812	

Sub-dimensions in independent variables		**Dependent variable**
Support : Admin		SUPPORT
Pearson Correlation	0.79*	
Sig. (2-tailed)	0.024	
N	812	
Support: Collegial		
Pearson Correlation	0.031	
Sig. (2-tailed)	0.385	
N	812	
Training: Consequence		TRAINING
Pearson Correlation	0.398**	
Sig. (2-tailed)	0.000	
N	763	
Training : Value		
Pearson Correlation	0.175**	
Sig. (2-tailed)	0.000	
N	812	
Training: Importance		
Pearson Correlation	0.135**	
Sig. (2-tailed)	0.000	
N	787	
Pedagogy: Importance		PEDAGOGY
Pearson Correlation	0.123**	
Sig. (2-tailed)	0.000	
N	812	
Pedagogy: Confidence		
Pearson Correlation	0.628**	

Sub-dimensions in independent variables		Dependent variable
		PEDAGOGY
Sig. (2-tailed)	0.000	
N	812	
Pedagogy: Productivity		
Pearson Correlation	0.179**	
Sig. (2-tailed)	0.000	
N	812	

**. Correlation is significant at the 0.01 level (2-tailed).
*. Correlation is significant at the 0.05 level (2-tailed).

Table 6.31 provides an illustration of the sub-dimensions in the independent variables with the related score to the dependent variable. It is evident from the table that most of the sub-dimensions of the independent variables are significantly associated with educators' computer utilisation in classrooms.

However, there are five variables which have a negative relationship to the dependent variable, the lowest being 'access problems' which is not statistically significant to access to computers (p<0.117). From the table above it is evident that there are differences in the groups. In addition, associations were sought between all the independent variables including the sub-dimensions and the educators' age, by computing Multiple Comparisons, using Post Hoc Analysis.

The results that were significant are presented in Tables 6.32 to 6.72 below. Due to the length of the complete report, the detailed statistics are available upon request.

The following section highlights the significant differences found in the analyses and a discussion of the findings. This will be further addressed in Chapter Eight.

Table 6.32 depicts the differences in age groups regarding the educators' theories and beliefs.

Table 6.32 Differences among age groups in terms of educator beliefs

Dependent Variable	(I) Recode Age	(J) Recode Age	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval Lower Bound	95% Confidence Interval Upper Bound
Educator theories and beliefs (Total)	20-39 Years	40-49 Years	0.93542	0.82385	0.525	-1.0849	2.9557
		50 and above	**-2.52206***	0.92819	0.025	-4.7982	-.2459
	40-49 Years	20-39 Years	-0.93542	0.82385	0.525	-2.9557	1.0849
		50 and above	**-3.45748***	0.90874	0.001	-5.6860	-1.2290
	50 and above	20-39 Years	**2.52206***	0.92819	0.025	0.2459	4.7982
		40-49 Years	**3.45748***	0.90874	0.001	1.2290	5.6860

*. The mean difference is significant at the 0.05 level.

The above table serves to answer the question of whether the groups differ from the independent variable and whether there is a significant difference between the groups. The multiple comparisons in Table 6.32 above clearly indicate that there are significant differences between age and the highlighted independent variables.
The only significant outcome in this table about the educators' theories and beliefs is in the age group 50 and above, compared with educators in the (40-49) and (20-39) year age groups. Educator Beliefs (Mean Difference = 3.45748* and $p<0.05$).

Table 6.33 illustrates the differences in the educators' age groups regarding the educators' access to computers.

Table 6.34 presents the differences among the educators' age groups in terms of the educators' attitude towards the use of computers in secondary schools.

Table 6.33 Differences among age groups in terms of access problems

Dependent Variable	(I) Recode Age	(J)Recode Age	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval Lower Bound	95% Confidence Interval Upper Bound
Problems associated with access to computers (Total)	20-39 Years	40-49 Years	-0.52431	0.50607	0.585	-1.7653	0.7167
		50 and above	0.98795	0.57017	0.223	-0.4103	2.3862
	40-49 Years	20-39 Years	0.52431	0.50607	0.585	-0.7167	1.7653
		50 and above	**1.51225***	0.55822	0.026	0.1433	2.8812
	50 and above	20-39 Years	-0.98795	0.57017	0.223	-2.3862	0.4103
		40-49 Years	**-1.51225***	0.55822	0.026	-2.8812	-0.1433

*. The mean difference is significant at the 0.05 level.

According to Table 6.33, there are significant differences between educators in the age group 40-49 years when compared with educators in the age group 50 years and above, regarding problems with access to computers ($p<0.05$). In addition, there seems to be a strong negative relationship between educators in the age group 50 years and above when compared with educators in the 40-49 year-age group ($p<0.05$).

Table 6.34 Differences among age groups in terms of educator attitude

Dependent Variable	(I) Recode Age	(J) Recode Age	Mean Diff. (I-J)	Std. Error	Sig.	95% Confidence Interval Lower Bound	95% Confidence Interval Upper Bound
Educator attitude towards computers (Total)	20-39 Years	40-49 Years	0.51597	0.36916	0.377	-0.3893	1.4213
		50 and above	-0.78574	0.41592	0.169	-1.8057	0.2342
	40-49 Years	20-39 Years	-0.51597	0.36916	0.377	-1.4213	0.3893
		50 and above	**-1.30172***	0.40721	0.006	-2.3003	-0.3031
	50 and above	20-39 Years	0.78574	0.41592	0.169	-0.2342	1.8057
		40-49 Years	**1.30172***	0.40721	0.006	0.3031	2.3003

*. The mean difference is significant at the 0.05 level.

According to Table 6.34, there are significant differences between educators in the age group 50 years and above when compared with educators in the age group 40-49 years regarding the educators' attitudes towards computers (p<0.05). In addition, there seems to be a strong negative relationship between educators in the 40-49 age group when compared with educators in the 50 years and above age group (p<0.05).

Table 6.35 illustrates the difference among the educators' age groups and the support from the administration they have received.

Table 6.35 Differences among age groups in terms of administration support

Dependent Variable	(I) Recode Age	(J) Recode Age	Mean Diff. (I-J)	Std. Error	Sig.	95% Confidence Interval Lower Bound	95% Confidence Interval Upper Bound
Educator admin support factor 1 solution (Total)	20-39 Years	40-49 Years	0.37535	0.54312	0.788	-0.9565	1.7072
		50 and above	**-1.63562***	0.61191	0.029	-3.1362	-0.1351
	40-49 Years	20-39 Years	-0.37535	0.54312	0.788	-1.7072	0.9565
		50 and above	**-2.01097***	0.59909	0.004	-3.4801	-0.5418
	50 and above	20-39 Years	**1.63562***	0.61191	0.029	0.1351	3.1362
		40-49 Years	**2.01097***	0.59909	0.004	0.5418	3.4801

*. The mean difference is significant at the 0.05 level.

According to Table 6.35, there are significant differences between educators in the age group 50 years and above when compared with educators in the age group 40-49 years as regards administration support when using computers (p<0.05). In addition, there seems to be a strong negative relationship between educators in the 40-49 age group when compared with educators in the 50 years and above age group (p<0.05).

Table 6.36 depicts the difference among the educators' age groups and the consequence the training which they have received.

Table 6.36 Differences among age groups in terms of consequence of training

Dependent Variable	(I) Recode Age	(J) Recode Age	Mean Diff (I-J)	Std. Error	Sig.	95% Confidence Interval Lower Bound	95% Confidence Interval Upper Bound
Consequences of using computers training (Total)	20-39 Years	40-49 Years	-0.61065	0.5470	0.53	-1.9524	0.7311
		50 and above	**1.66653***	0.6126	0.02	0.1640	3.1690
	40-49 Years	20-39 Years	0.61065	0.5470	0.53	-0.7311	1.9524
		50 and above	**2.27718***	0.5987	.001	0.8088	3.7456
	50 and above	20-39 Years	**-1.66653***	0.6126	.025	-3.1690	-0.1640
		40-49 Years	**-2.27718***	0.5987	.001	-3.7456	-0.8088

*. The mean difference is significant at the 0.05 level.

According to Table 6.36, there are significant differences between educators in the age group 40-49 years when compared with educators in the age group 50 years and above regarding the consequences of educators using computers for instruction in the classrooms (p<0.05). In addition, there seems to be a strong negative relationship between educators in the age group 50 years and above when compared with educators in the 40-49 year-age group (p<0.05). Table 6.37 presents the differences between the educators' age group and their pedagogies.

Table 6.37 Differences among age groups in terms of educator pedagogy

Dependent Variable	(I) Recode Age	(J) Recode Age	Mean Diff (I-J)	Std. Error	Sig.	95% Confidence Interval Lower Bound	95% Confidence Interval Upper Bound
Educator pedagogy (Total)	20-39 Years	40-49 Years	0.84410	.92825	.662	-1.4322	3.1204
		50 and above	**4.52247***	1.04581	.000	1.9578	7.0871
	40-49 Years	20-39 Years	-.84410	.92825	.662	-3.1204	1.4322
		50 and above	**3.67837***	1.02390	.002	1.1675	6.1893
	50 and above	20-39 Years	**-4.52247***	1.04581	.000	-7.0871	-1.9578
		40-49 Years	**-3.67837***	1.02390	.002	-6.1893	-1.1675

*. The mean difference is significant at the 0.05 level.

According to Table 6.37, there are significant differences between educators in the age group 20-39 years when compared with educators in the age group 50 years and above regarding educator pedagogy (p<0.05).

In addition, there seems to be a strong negative relationship between educators in the age group 50 years and above when compared with educators in the 20-39 year age group (p<0.05).

Table 6.38 portrays the difference among the educators' ages groups and their pedagogical confidence in using computers in the classrooms.

Table 6.38 Differences among age groups in terms of pedagogy confidence

Dependent Variable	(I) Recode Age	(J) Recode Age	Mean Diff. (I-J)	Std. Error	Sig.	95% Confidence Interval Lower Bound	95% Confidence Interval Upper Bound
Educator pedagogy factor 2 confidence	20-39 Years	40-49 Years	**1.48750***	.56795	.033	.0947	2.8803
		50 and above	**3.62316***	.63988	.000	2.0540	5.1923
	40-49 Years	20-39 Years	**-1.48750***	.56795	.033	-2.8803	-.0947
		50 and above	**2.13566***	.62648	.003	.5994	3.6720
	50 and above	20-39 Years	**-3.62316***	.63988	.000	-5.1923	-2.0540
		40-49 Years	**-2.13566***	.62648	.003	-3.6720	-.5994

*. The mean difference is significant at the 0.05 level.

According to Table 6.38, there are significant differences between educators in the age group 20-39 years when compared with educators in the age group 50 years and above regarding educator confidence (p<0.05). In addition, there seems to be a strong negative relationship between educators in the age group 50 years and above when compared with educators in the 20-39 year age group (p<0.05).

Table 6.39 illustrates the differences among the educators' age groups and educators who have negative attitudes towards computers.

Table 6.39 Differences among age groups in terms of negative attitudes

Dependent Variable	(I) Recode Age	(J) Recode Age	Mean Diff. (I-J)	Std. Error	Sig.	95% Confidence Interval Lower Bound	95% Confidence Interval Upper Bound
Negative attitude towards computers	20-39 Years	40-49 Years	.67292	.48514	.383	-.5168	1.8626
		50 and above	-.95772	.54659	.216	-2.2981	.3827
	40-49 Years	20-39 Years	-.67292	.48514	.383	-1.8626	.5168
		50 and above	**-1.63064***	.53513	.010	-2.9429	-.3183
	50 and above	20-39 Years	.95772	.54659	.216	-.3827	2.2981
		40-49 Years	**1.63064***	.53513	.010	.3183	2.9429

*. The mean difference is significant at the 0.05 level.

According to Table 6.39, there are significant differences between educators in the age group 50 years and above when compared with educators in the age group 40-49 years regarding educators' negative attitudes towards computers ($p<0.5$). In addition, there seems to be a strong negative relationship between educators in the 40-49 age group when compared with educators in the 50 years and above age group ($p<0.05$). Table 6.40 highlights the differences among the educators' age groups and educators' that have positive attitudes towards computers.

Table 6.40 Differences among age groups in terms of positive attitudes

Dependent Variable	(I) Recode Age	(J) Recode Age	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval Lower Bound	95% Confidence Interval Upper Bound
Positive attitude towards computers	20-39 Years	40-49 Years	0.28542	.30709	.649	-.4677	1.0385
		50 and above	-.62868	.34599	.193	-1.4771	.2198
	40-49 Years	20-39 Years	-.28542	.30709	.649	-1.0385	.4677
		50 and above	**-.91409***	.33874	.027	-1.7448	-.0834
	50 and above	20-39 Years	0.62868	.34599	.193	-.2198	1.4771
		40-49 Years	**.91409***	.33874	.027	.0834	1.7448

*. The mean difference is significant at the 0.05 level.

According to Table 6.40, there are significant differences between educators in the age group 50 years and above when compared with educators in the age group 40-49 years regarding educators' positive attitudes towards computers ($p<0.05$).

In addition, there seems to be a strong negative relationship between educators in the 40-49 age group when compared with educators in the 50 years and above age group ($p<0.05$).

Table 6.41 Differences among age groups in terms of positive beliefs

Dependent Variable	(I) Recode Age	(J) Recode Age	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval Lower Bound	95% Confidence Interval Upper Bound
Educator positive theories and beliefs	20-39 Years	40-49 Years	.79236	.35459	.083	-.0772	1.6619
		50 and above	-.66279	.39950	.253	-1.6425	.3169
	40-49 Years	20-39 Years	-.79236	.35459	.083	-1.6619	.0772
		50 and above	**-1.45515***	.39113	.001	-2.4143	-.4960
	50 and above	20-39 Years	.66279	.39950	.253	-.3169	1.6425
		40-49 Years	**1.45515***	.39113	.001	.4960	2.4143

*. The mean difference is significant at the 0.05 level.

According to Table 6.41, there are significant differences between educators in the age group 50 years and above when compared with educators in the age group 40-49 years regarding educators' positive beliefs towards computers ($p<0.05$). In addition, there seems to be a strong negative relationship between educators in the 40-49 age group when compared with educators in the 50 years and above age group ($p<0.05$).

Table 6.42 displays the difference among the educators' age groups and their negative theories and beliefs about the use of computers in schools. Table 6.43 illustrates the difference among age groups and collegial support between secondary school educators.

Table 6.42 Differences among age groups in terms of negative beliefs

Dependent Variable	(I) Recode Age	(J) Recode Age	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval Lower Bound	95% Confidence Interval Upper Bound
Educator negative theories and beliefs	20-39 Years	40-49 Years	0.14306	.64520	.976	-1.4392	1.7253
		50 and above	**-1.85927***	.72692	.038	-3.6419	-.0767
	40-49 Years	20-39 Years	-.14306	.64520	.976	-1.7253	1.4392
		50 and above	**-2.00233***	.71169	.019	-3.7476	-.2571
	50 and above	20-39 Years	**1.85927***	.72692	.038	.0767	3.6419
		40-49 Years	**2.00233***	.71169	.019	.2571	3.7476

*. The mean difference is significant at the 0.05 level.

According to Table 6.42, there are significant differences between educators in the age group 50 years and above when compared with educators in the age group 40-49 years regarding educators' negative beliefs towards computers ($p<0.05$). In addition, there seems to be a strong negative relationship between educators in the 40-49 age group when compared with educators in the 50 years and above age group ($p<0.05$).

Table 6.43 Differences among age groups in terms of collegial support

Dependent Variable	(I) Recode Age	(J) Recode Age	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval Lower Bound	95% Confidence Interval Upper Bound
Educators support using computers factor 2 (collegial support)	20-39 Years	40-49 Years	-.24028	.18668	.437	-.6981	.2175
		50 & above	**-.79065***	.21032	.001	-1.3064	-.2749
	40-49 Years	20-39 Years	0.24028	.18668	.437	-.2175	.6981
		50 & above	**-.55037***	.20591	.029	-1.0553	-.0454
	50 and above	20-39 Years	**.79065***	.21032	.001	.2749	1.3064
		40-49 Years	**.55037***	.20591	.029	.0454	1.0553

*. The mean difference is significant at the 0.05 level.

According to Table 6.43, there are significant differences between educators in the age group 50 years and above when compared with educators in the age group 20-39 years regarding educators' collegial support when using computers (p<0.05).

In addition, there seems to be a strong negative relationship between educators in the 20-39 age group when compared with educators in the 50 years and above age group (p<0.05).

Table 6.44 portrays the difference among educators' age groups and the sub-dimension, procedures, in the dependent variable.

Table 6.44 Differences among age groups in terms of procedures in the dependent variable

Dependent Variable	(I) Recode Age	(J) Recode Age	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval Lower Bound	95% Confidence Interval Upper Bound
Educator computer use factor 2 (procedure)	20-39 Years	40-49 Years	**1.08160***	.32932	.005	.2740	1.8892
		50 and above	**2.82087***	.37103	.000	1.9110	3.7308
	40-49 Years	20-39 Years	**-1.08160***	.32932	.005	-1.8892	-.2740
		50 and above	**1.73928***	.36326	.000	.8485	2.6301
	50 and above	20-39 Years	**-2.82087***	.37103	.000	-3.7308	-1.9110
		40-49 Years	**-1.73928***	.36326	.000	-2.6301	-.8485

*. The mean difference is significant at the 0.05 level.

According to Table 6.44, there are significant differences between educators in the age group 20-39 years when compared with educators in the age group 50 years and above regarding the sub-dimension, procedures in the dependent variable (p<0.05). In addition, there seems to be a strong negative relationship between educators in the age group 50 years and above when compared with educators in the 20-39 year age group (p<0.05).

Table 6.45 presents the differences among the educators' age groups and the dependent variable.

Table 6.45 Differences among age groups in terms of dependent variable

Dependent Variable	(I) Recode Age	(J) Recode Age	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval Lower Bound	95% Confidence Interval Upper Bound
Educator computer use 2 factor solution (total dv)	20-39 Years	40-49 Years	**4.49861***	1.04899	.000	1.9262	7.0710
		50 & above	**9.33967***	1.18185	.000	6.4414	12.2379
	40-49 Years	20-39 Years	**-4.49861***	1.04899	.000	-7.0710	-1.9262
		50 & above	**4.84105***	1.15709	.000	2.0035	7.6786
	50 and above	20-39 Years	**-9.33967***	1.18185	.000	-12.2379	-6.4414
		0-49 Years	**-4.84105***	1.15709	.000	-7.6786	-2.0035

*. The mean difference is significant at the 0.05 level.

According to Table 6.45, there are significant differences between educators in the age group 20-39 years when compared with educators in the age group 50 years and above regarding the combined two factor solution of the dependent variable ($p<0.05$).

In addition, there seems to be a strong negative relationship between educators in the age group 50 years and above when compared with educators in the 20-39 year age group ($p<0.05$).

In summary the Multiple Comparisons between the variables provided evidence that there were significant differences in the groups being compared. Groups that have significant differences have been illustrated and discussions on the differences will continue in the following chapter.

Furthermore, associations were sought between all the independent variables including the sub-dimensions and years of teaching experience by computing Multiple Comparisons using Post Hoc Analysis. The results that were significant are presented below and the complete report is appended as Appendix G.

6.18.2 Teaching experience

Table 6.46 depicts the difference between the years of teaching experience and the educators' confidence in their pedagogies.

Table 6.46 Differences among years of teaching experience in terms of pedagogy confidence

Dependent Variable	(I) How many years of teaching experience do you have at the secondary school level	(J) How many years of teaching experience do you have at the secondary school level	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval Lower Bound	95% Confidence Interval Upper Bound
Educator pedagogy factor 2 (confidence)	1 - 5	6 - 10	2.02451	.81212	.185	-.4828	4.5318
		11 - 15	1.49852	.84920	.539	-1.1233	4.1203
		16 - 20	**2.71574***	.83699	.033	.1316	5.2998
		21 years or more	**3.41448***	.69429	.000	1.2710	5.5580
	16 - 20	1 - 5	**-2.71574***	.83699	.033	-5.2998	-.1316
		6 - 10	-.69123	.87275	.960	-3.3858	2.0033
		11 - 15	-1.21722	.90736	.773	-4.0186	1.5841
		21 years or more	.69874	.76433	.934	-1.6610	3.0585
	21 years or more	1 - 5	**-3.41448***	.69429	.000	-5.5580	-1.2710
		6 - 10	-1.38997	.73701	.470	-3.6654	.8855
		11 - 15	-1.91595	.77768	.195	-4.3169	.4850
		16 - 20	-.69874	.76433	.934	-3.0585	1.6610

*. The mean difference is significant at the 0.05 level.

It is reported in Table 6.46 that when confidence in educator pedagogy is compared with the years of teaching experience educators have in secondary schools, the scores indicate that there are significant differences between the highlighted variables. The significant difference is between educators who have 1-5 years of teaching experience compared with educators who have 21 years or more of teaching experience ($p<0.05$).

In addition, there seems to be a strong negative relationship between educators who have 21 years or more teaching experience when compared with educators who have only between 1-5 years of teaching experience ($p<0.05$).

Table 6.47 illustrates the difference between the years of educator teaching experience and the amount of collegial support they received.

Table 6.47 Differences among years of teaching experience in terms of collegial support

Dependent Variable	(I) How many years of teaching experience do you have at the secondary school level	(J) How many years of teaching experience do you have at the secondary school level	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval Lower Bound	95% Confidence Interval Upper Bound
Educator support using computers factor 2 (collegial support)	1 - 5	6 - 10	-.11900	.26535	.995	-.9382	.7002
		11 - 15	-.22300	.27747	.958	-1.0796	.6336
		16 - 20	-.18256	.27348	.979	-1.0269	.6618
		21 years or more	**-.83468***	.22685	.009	-1.5351	-.1343
	21 years or more	1 – 5	**.83468***	.22685	.009	.1343	1.5351
		6 - 10	.71568	.24081	.066	-.0278	1.4592
		11 - 15	.61168	.25410	.216	-.1728	1.3962
		16 - 20	.65212	.24974	.147	-.1189	1.4232

*. The mean difference is significant at the 0.05 level.

It is reported in Table 6.47 that when educator collegial support is compared with the years of teaching experience educators have in secondary schools, the scores indicate that there are significant differences between the highlighted variables. The significant difference is between educators who have 21 years or more teaching experience compared with educators who have 1-5 years of teaching experience ($p<0.05$).

Table 6.48 presents the differences among the educators' years of teaching experience and the sub-dimension, function, in the dependent variable.

Table 6.48 Differences among years of teaching experience in terms of function in the dependent variable

Dependent Variable	(I) How many years of teaching experience do you have at the secondary school level	(J) How many years of teaching experience do you have at the secondary school level	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval Lower Bound	95% Confidence Interval Upper Bound
Educator use of computers factor 1 (function)	1 - 5	6 – 10	3.07401	1.16471	.139	-.5219	6.6699
		11 – 15	3.59301	1.21788	.070	-.1670	7.3531
		16 – 20	**4.98137***	1.20038	.002	1.2754	8.6874
		21 years or more	**6.21751***	.99572	.000	3.1434	9.2917
	16 - 20	1 – 5	**-4.98137***	1.20038	.002	-8.6874	-1.2754
		6 – 10	-1.90736	1.25167	.677	-5.7717	1.9570
		11 – 15	-1.38837	1.30129	.888	-5.4059	2.6292
		21 years or more	1.23613	1.09617	.866	-2.1481	4.6204
	21 years or more	1 – 5	**-6.21751***	.99572	.000	-9.2917	-3.1434
		6 – 10	-3.14350	1.05699	.066	-6.4068	.1198
		11 – 15	-2.62450	1.11531	.238	-6.0679	.8189
		16 – 20	-1.23613	1.09617	.866	-4.6204	2.1481

*. The mean difference is significant at the 0.05 level.

It is reported in Table 6.48 that when function in the dependent variable is compared with the years of teaching experience educators have in secondary schools, the scores indicate that there are significant differences between the highlighted variables. The significant difference is between educators who have 1-5 years of teaching experience compared with educators who have 21 years or more teaching experience ($p<0.05$). In addition, there seems to be a strong negative relationship between educators who have 21 years or more teaching experience when compared with educators who have between 1-5 years of teaching experience ($p<0.05$).

Table 6.49 depicts the differences in years of educator teaching experience and the sub-dimension, procedures, in the dependent variable.

Table 6.49 Differences among years of teaching experience in terms of procedures in the dependent variable

Dependent Variable	(I) How many years of teaching experience do you have at the secondary school level	(J) How many years of teaching experience do you have at the secondary school level	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval Lower Bound	95% Confidence Interval Upper Bound
Educator use of computers Factor 2 (Procedures)	1 - 5	6 - 10	.84844	.47565	.528	-.6201	2.3170
		11 - 15	.27941	.49737	.989	-1.2562	1.8150
		16 - 20	1.33215	.49022	.118	-.1813	2.8456
		21 years or more	**2.13838***	.40664	.000	.8829	3.3938
	11 - 15	1 - 5	-.27941	.49737	.989	-1.8150	1.2562
		6 - 10	.56903	.51803	.877	-1.0303	2.1684
		16 - 20	1.05274	.53143	.417	-.5880	2.6935
		21 years or more	**1.85897***	.45548	.002	.4527	3.2652
	21 years or more	1 - 5	**-2.13838***	.40664	.000	-3.3938	-.8829
		6 - 10	-1.28994	.43166	.064	-2.6226	.0428
		11 - 15	**-1.85897***	.45548	.002	-3.2652	-.4527
		16 - 20	-.80623	.44766	.518	-2.1883	.5759

*. The mean difference is significant at the 0.05 level.

It is reported in Table 6.49 that when procedures in the dependent variable is compared to the years of teaching experience educators have in secondary schools, the scores indicate that there are significant differences between the highlighted variables. The significant difference is between educators who have 1-5 years of teaching experience compared to educators who have 21 years or more teaching experience ($p<0.05$). In addition, there seems to be a strong negative relationship between educators who have 21 years or more teaching experience when compared to educators who have between 1-5 years of teaching experience ($p<0.05$).

Table 6.50 presents the differences of the years of educator teaching experience to the dependent variable.

Table 6.50 Differences among years of teaching experience in terms of a two-factor solution in the dependent variable

Dependent Variable	(I) How many years of teaching experience do you have at the secondary school level	(J) How many years of teaching experience do you have at the secondary school level	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval Lower Bound	95% Confidence Interval Upper Bound
Educator use of computers 2 factors total solution (dv)	1 – 5	6 - 10	3.92245	1.51009	.151	-.7397	8.5846
		11 - 15	3.87242	1.57903	.199	-1.0026	8.7475
		16 - 20	**6.31353***	1.55633	.003	1.5086	11.1185
		21 years or more	**8.35589***	1.29099	.000	4.3701	12.3416
	6 – 10	1 - 5	-3.92245	1.51009	.151	-8.5846	.7397
		11 - 15	-.05003	1.64461	1.000	-5.1276	5.0275
		16 - 20	2.39107	1.62284	.704	-2.6192	7.4014
		21 years or more	**4.43344***	1.37043	.034	.2024	8.6645
	11 – 15	1 - 5	-3.87242	1.57903	.199	-8.7475	1.0026
		6 - 10	.05003	1.64461	1.000	-5.0275	5.1276
		16 - 20	2.44111	1.68718	.719	-2.7678	7.6501
		21 years or more	**4.48348***	1.44604	.048	.0190	8.9479
	16 – 20	1 - 5	**-6.31353***	1.55633	.003	-11.1185	-1.5086
		6 - 10	-2.39107	1.62284	.704	-7.4014	2.6192
		11 - 15	-2.44111	1.68718	.719	-7.6501	2.7678
		21 years or more	2.04237	1.42122	.724	-2.3455	6.4302
	21 years or more	1 - 5	**-8.35589***	1.29099	.000	-12.3416	-4.3701
		6 - 10	**-4.43344***	1.37043	.034	-8.6645	-.2024
		11 - 15	**-4.48348***	1.44604	.048	-8.9479	-.0190
		16 - 20	-2.04237	1.42122	.724	-6.4302	2.3455

*. The mean difference is significant at the 0.05 level.

It is reported in Table 6.50 that when the sum of the two factors in the dependent variable is compared with the years of teaching experience educators have in secondary schools, the scores indicate that there are significant differences between the highlighted variables. The significant difference is between educators who have 1-5 years of teaching experience compared with educators who have 21 years or more teaching experience ($p<0.05$). In addition, there seems to be a strong negative relationship between educators who have 21 years or more teaching experience when compared with educators who have between 1-5 years of teaching experience ($p<0.05$).

In summary, the Multiple Comparisons between the variables have provided evidence that there are significant differences in the groups being compared. Groups that have significant differences have been highlighted and discussions on the differences will continue in chapter 8. In addition, associations were sought between all the independent variables, including the sub-dimensions and the level of computer expertise, by computing Multiple Comparisons using Post Hoc Analysis. The results that were significant are presented below and the complete report is appended as Appendix G.

6.18.3 Computer expertise

Table 6.51 Differences regarding educators' computer expertise in terms of educators' theories and beliefs

Dependent Variable	(I) Recoded Level of Expertise (3 Groups)	(J) Recoded Level of Expertise (3 Groups)	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval Lower Bound	95% Confidence Interval Upper Bound
Educator theories and beliefs (total)	Beginner	Average	**5.13669***	.82964	.000	3.1022	7.1712
		Advanced	**11.68106***	.92809	.000	9.4051	13.9570
	Average	Beginner	**-5.13669***	.82964	.000	-7.1712	-3.1022
		Advanced	**6.54437***	.77857	.000	4.6351	8.4536
	Advanced	Beginner	**-11.68106***	.92809	.000	-13.9570	-9.4051
		Average	**-6.54437***	.77857	.000	-8.4536	-4.6351

*. The mean difference is significant at the 0.05 level.

It is reported in Table 6.51 that when educators' theories and beliefs are compared with the educators' level of computer expertise, the scores indicate that there are significant differences between the highlighted variables. The significant difference is between educators who rated themselves as beginners with respect to the various levels of computer usage compared with those educators who rated themselves as advanced computer users (p<0.05).

In addition, there seems to be a strong negative relationship between educators who have rated themselves as advanced computer users when compared with educators who have rated themselves as beginners of computer usage (p<0.05).

Table 6.52 illustrates the differences between the educators' computer expertise and the frequency of access.

Table 6.52 Differences regarding educators' computer expertise in terms of frequency of access

Dependent Variable	(I) Recode Level of Expertise (3 Groups)	(J) Recode Level of Expertise (3 Groups)	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval Lower Bound	95% Confidence Interval Upper Bound
Frequency of access to computers (total)	Beginner	Average	**-1.83345***	.46039	.000	-2.9625	-.7044
		Advanced	**-4.28955***	.51503	.000	-5.5525	-3.0266
	Average	Beginner	**1.83345***	.46039	.000	.7044	2.9625
		Advanced	**-2.45610***	.43205	.000	-3.5156	-1.3966
	Advanced	Beginner	**4.28955***	.51503	.000	3.0266	5.5525
		Average	**2.45610***	.43205	.000	1.3966	3.5156

*. The mean difference is significant at the 0.05 level.

It is reported in Table 6.52 that when the educators' frequency of access to computers is compared with the educators' level of computer expertise, the scores indicate that there are significant differences between the highlighted variables. The significant difference is between educators who rated themselves as advanced with respect to the various levels of computer usage compared with educators who rated themselves as beginners in computer usage (p<0.05).

In addition, there seems to be a strong negative relationship between educators who have rated themselves as beginners of computer usage when compared with educators who have rated themselves as advanced computer users (p<0.05).

Table 6.53 depicts the differences between the educators' computer expertise and their attitudes.

Table 6.53 Differences regarding educators' computer expertise in terms of educator attitude

Dependent Variable	(I) Recode Level of Expertise	(J) Recode Level of Expertise	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval Lower Bound	95% Confidence Interval Upper Bound
Educator's attitude towards computers (total)	Beginner	Average	**1.85089***	.38369	.000	.9100	2.7918
		Advanced	**4.19351***	.42922	.000	3.1409	5.2461
	Average	Beginner	**-1.85089***	.38369	.000	-2.7918	-.9100
		Advanced	**2.34262***	.36007	.000	1.4596	3.2256
	Advanced	Beginner	**-4.19351***	.42922	.000	-5.2461	-3.1409
		Average	**-2.34262***	.36007	.000	-3.2256	-1.4596

*. The mean difference is significant at the 0.05 level.

It is reported in Table 6.53 that when the educators' attitude towards computers is compared with the educators' level of computer expertise, the scores indicate that there are significant differences between the highlighted variables. The significant difference is between educators who rated themselves as beginners with respect to the various levels of computer usage compared with educators who rated themselves as advanced computer users (p<0.05).

In addition, there seems to be a strong negative relationship between educators who have rated themselves as advanced computer users when compared with educators who have rated themselves as beginners in computer usage (p<0.05).

Table 6.54 presents the differences between the educators' expertise and the consequences of training. Table 6.55 depicts the differences between the educators' expertise and the value of training.

Table 6.54 Differences regarding educators' computer expertise in terms of the consequences of training

Dependent Variable	(I) Recode Level of Expertise	(J) Recode Level of Expertise	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval Lower Bound	95% Confidence Interval Upper Bound
Consequences of using computers (total)	Beginner	Average	**-2.44652***	.58493	.000	-3.8811	-1.0119
		Advanced	**-5.36537***	.65473	.000	-6.9711	-3.7596
	Average	Beginner	**2.44652***	.58493	.000	1.0119	3.8811
		Advanced	**-2.91885***	.53917	.000	-4.2412	-1.5965
	Advanced	Beginner	**5.36537***	.65473	.000	3.7596	6.9711
		Average	**2.91885***	.53917	.000	1.5965	4.2412

*. The mean difference is significant at the 0.05 level.

It is reported in Table 6.54 that when the consequences of educators' training are compared with the educators' levels of computer expertise, the scores indicate that there are significant differences between the highlighted variables. The significant difference is between educators who rated themselves as advanced computer users with respect to the various levels of computer usage compared with educators who rated themselves as beginners in computer usage ($p<0.05$). In addition, there seems to be a strong negative relationship between educators who have rated themselves as beginners in computer usage when compared with educators who have rated themselves as advanced computer users ($p<0.05$).

Table 6.55 Differences regarding educators' computer expertise in terms of the value of training

Dependent Variable	(I) Recode Level of Expertise	(J) Recode Level of Expertise	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval Lower Bound	95% Confidence Interval Upper Bound
Value of computer training (total)	Beginner	Average	**-1.65023***	.43531	.001	-2.7177	-.5827
		Advanced	**-2.35615***	.48697	.000	-3.5503	-1.1620
	Average	Beginner	**1.65023***	.43531	.001	.5827	2.7177
		Advanced	**-.70592**	.40852	.225	-1.7077	.2959
	Advanced	Beginner	**2.35615***	.48697	.000	1.1620	3.5503
		Average	.70592	.40852	.225	-.2959	1.7077

*. The mean difference is significant at the 0.05 level.

It is reported in Table 6.55 that when the value of the educators' computer training is compared with the educators' level of computer expertise, the scores indicate that there are significant differences between the highlighted variables. The significant difference is between educators who rated themselves as advanced computer users with respect to the various levels of computer usage compared with educators who rated themselves as beginners in computer usage ($p<0.05$). In addition, there seems to be a strong negative relationship between educators who have rated themselves as beginners in computer usage when compared with educators who have rated themselves as advanced computer users ($p<0.05$).

Table 6.56 illustrates the differences between the educators' expertise and the importance of training.

Table 6.56 Differences regarding educators' computer expertise in terms of the importance of computer training

Dependent Variable	(I) Recode Level of Expertise	(J) Recode Level of Expertise	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval Lower Bound	95% Confidence Interval Upper Bound
Importance of computer training (total)	Beginner	Average	**-1.80526***	.42552	.000	-2.8488	-.7617
		Advanced	**-1.38854***	.47747	.015	-2.5595	-.2176
	Average	Beginner	**1.80526***	.42552	.000	.7617	2.8488
		Advanced	.41672	.39871	.579	-.5611	1.3945
	Advanced	Beginner	**1.38854***	.47747	.015	.2176	2.5595
		Average	-.41672	.39871	.579	-1.3945	.5611

*. The mean difference is significant at the 0.05 level.

It is reported in Table 6.56 that when the importance of the educators' computer training is compared with the educators' level of computer expertise, the scores indicate that there are significant differences between the highlighted variables. The significant difference is between educators who rated themselves as advanced computer users with respect to the various levels of computer usage compared with educators who rated themselves as beginners in computer usage ($p<0.05$). In addition, there seems to be a strong negative relationship between educators who have rated themselves as beginners in computer usage when compared with educators who have rated themselves as advanced computer users ($p<0.05$).

Table 6.57 to 6.60 depicts the difference between computer expertise and pedagogy.

Table 6.57 Differences regarding educators' computer expertise in terms of educator pedagogy

Dependent Variable	(I) Recode Level of Expertise	(J) Recode Level of Expertise	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval Lower Bound	95% Confidence Interval Upper Bound
Educator pedagogy (total)	Beginner	Average	**-5.05230***	.96534	.000	-7.4196	-2.6850
		Advanced	**-11.10876***	1.07990	.000	-13.7570	-8.4605
	Average	Beginner	**5.05230***	.96534	.000	2.6850	7.4196
		Advanced	**-6.05646***	.90592	.000	-8.2780	-3.8349
	Advanced	Beginner	**11.10876***	1.07990	.000	8.4605	13.7570
		Average	**6.05646***	.90592	.000	3.8349	8.2780

*. The mean difference is significant at the 0.05 level.

It is reported in Table 6.57 that when educator pedagogy is compared with the educators' level of computer expertise, the scores indicate that there are significant differences between the highlighted variables. The significant difference is between educators who rated themselves as advanced computer users with respect to the various levels of computer usage compared with educators who rated themselves as beginners in computer usage ($p<0.05$). In addition, there seems to be a strong negative relationship between educators who have rated themselves as beginners in computer usage when compared with educators who have rated themselves as advanced computer users ($p<0.05$).

Table 6.58 Differences regarding educators' computer expertise in terms of pedagogy importance

Dependent Variable	(I) Recode Level of Expertise	(J) Recode Level of Expertise	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval Lower Bound	95% Confidence Interval Upper Bound
Educator pedagogy factor 1 (importance)	Beginner	Average	-.61423	.44054	.379	-1.6946	.4661
		Advanced	**-1.47604***	.49282	.012	-2.6846	-.2675
	Advanced	Beginner	**1.47604***	.49282	.012	.2675	2.6846
		Average	.86181	.41342	.115	-.1520	1.8756

*. The mean difference is significant at the 0.05 level.

It is reported in Table 6.58 that when the importance of educator pedagogy is compared with the educators' level of computer expertise, the scores indicate that there are significant differences between the highlighted variables. The significant difference is between educators who rated themselves as advanced computer users with respect to the various levels of computer usage compared with those educators who rated themselves as beginners in computer usage ($p<0.05$). In addition, there seems to be a strong negative relationship between educators who have rated themselves as beginners in computer usage when compared with educators who have rated themselves as advanced computer users ($p<0.05$).

Table 6.59 Differences regarding educators' computer expertise in terms of pedagogy confidence

Dependent Variable	(I) Recode Level of Expertise	(J) Recode Level of Expertise	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval Lower Bound	95% Confidence Interval Upper Bound
Educator pedagogy factor 2 (confidence)	Beginner	Average	**-3.98923***	.56989	.000	-5.3868	-2.5917
		Advanced	**-8.70924***	.63752	.000	-10.2726	-7.1459
	Average	Beginner	**3.98923***	.56989	.000	2.5917	5.3868
		Advanced	**-4.72001***	.53481	.000	-6.0315	-3.4085
	Advanced	Beginner	**8.70924***	.63752	.000	7.1459	10.2726
		Average	**4.72001***	.53481	.000	3.4085	6.0315

*. The mean difference is significant at the 0.05 level.

It is reported in Table 6.59 that when the confidence of educator pedagogy is compared with the educators' level of computer expertise, the scores indicate that there are significant differences between the highlighted variables. The significant difference is between educators who rated themselves as advanced computer users with respect to the various levels of computer usage compared with educators who rated themselves as beginners in computer usage ($p<0.05$).

In addition, there seems to be a strong negative relationship between educators who have rated themselves as beginners in computer usage when compared with educators who have rated themselves as advanced computer users ($p<0.05$).

Table 6.60 Differences regarding educators' computer expertise in terms of pedagogy productivity

Dependent Variable	(I) Recode Level of Expertise	(J) Recode Level of Expertise	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval Low. Bound	95% Confidence Interval Up.Bound
Educator pedagogy factor 3 (productivity)	Beginner	Average	-.44884	.25341	.209	-1.0703	.1726
		Advanced	**-.92348***	.28348	.005	-1.6187	-.2283
	Advanced	Beginner	**.92348***	.28348	.005	.2283	1.6187
		Average	.47464	.23781	.137	-.1085	1.0578

*. The mean difference is significant at the 0.05 level.

It is reported in Table 6.60 that when the productivity of educator pedagogy is compared with the educators' level of computer expertise, the scores indicate that there are significant differences between the highlighted variables. The only significant difference is between educators who rated themselves as advanced computer users with respect to the various levels in computer usage compared with educators who rated themselves as beginners in computer usage ($p<0.05$). In addition, there seems to be a strong negative relationship between educators who have rated themselves as beginners in computer usage when compared with educators who have rated themselves as advanced computer users ($p<0.05$). Table 6.61 portrays the difference between educators' computer expertise and their negative attitudes towards computers.

Table 6.61 Differences regarding educators' computer expertise in terms of negative attitudes towards computers

Dependent Variable	(I) Recode Level of Expertise	(J) Recode Level of Expertise	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval Low.Bound	95% Confidence Interval Up.Bound
Negative attitude towards computers	Beginner	Average	**3.49710***	.49829	.000	2.2752	4.7190
		Advanced	**6.05775***	.55742	.000	4.6908	7.4247
	Average	Beginner	**-3.49710***	.49829	.000	-4.7190	-2.2752
		Advanced	**2.56065***	.46761	.000	1.4139	3.7074
	Advanced	Beginner	**-6.05775***	.55742	.000	-7.4247	-4.6908
		Average	**-2.56065***	.46761	.000	-3.7074	-1.4139

*. The mean difference is significant at the 0.05 level.

It is reported in Table 6.61 that when educator negative attitudes towards computers is compared with the educators' level of computer expertise, the scores indicate that there are significant differences between the highlighted variables. The significant difference is between educators who rated themselves as beginners with respect to the various levels of computer usage compared with educators who rated themselves as advanced computer users ($p<0.05$).

In addition, there seems to be a strong negative relationship between educators who have rated themselves as advanced computer users when compared with educators who have rated themselves as beginners of computer usage ($p<0.05$).

Table 6.62 presents the differences between educators' computer expertise and their positive attitudes towards computers.

Table 6.62 Differences regarding educators' computer expertise in terms of positive attitudes towards computers

Dependent Variable	(I) Recode Level of Expertise	(J) Recode Level of Expertise	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval Lower Bound	95% Confidence Interval Upper Bound
Positive attitude towards computers	Beginner	Average	**1.57313***	.31909	.000	.7906	2.3556
		Advanced	**3.44872***	.35696	.000	2.5734	4.3241
	Average	Beginner	**-1.57313***	.31909	.000	-2.3556	-.7906
		Advanced	**1.87559***	.29945	.000	1.1413	2.6099
	Advanced	Beginner	**-3.44872***	.35696	.000	-4.3241	-2.5734
		Average	**-1.87559***	.29945	.000	-2.6099	-1.1413

*. The mean difference is significant at the 0.05 level.

It is reported in Table 6.62 that when educator positive attitudes towards computers are compared with the educators' level of computer expertise, the scores indicate that there are significant differences between the highlighted variables.

The significant difference is between educators who rated themselves as beginners with respect to the various levels of computer usage compared with educators who rated themselves as advanced computer users ($p<0.05$).

In addition, there seems to be a strong negative relationship between educators who have rated themselves as advanced computer users when compared with educators who have rated themselves as beginners of computer usage ($p<0.05$).

Table 6.63 illustrates the differences between the educators' computer expertise and their positive theories and beliefs about the use of computers in schools.

Table 6.63 Differences regarding educators' computer expertise in terms of positive theories and beliefs

Dependent Variable	(I) Recode Level of Expertise	(J) Recode Level of Expertise	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval Lower Bound	95% Confidence Interval Upper Bound
Positive theories and beliefs	Beginner	Average	.91683	.38032	.055	-.0158	1.8495
		Advanced	**2.77527***	.42545	.000	1.7319	3.8186
	Average	Beginner	-.91683	.38032	.055	-1.8495	.0158
		Advanced	**1.85844***	.35691	.000	.9832	2.7337
	Advanced	Beginner	**-2.77527***	.42545	.000	-3.8186	-1.7319
		Average	**-1.85844***	.35691	.000	-2.7337	-.9832

*. The mean difference is significant at the 0.05 level.

It is reported in Table 6.63 that when educator positive theories and beliefs towards computers are compared with the educators' level of computer expertise, the scores indicate that there are significant differences between the highlighted variables. The significant difference is between educators who rated themselves as beginners with respect to the various levels of computer usage compared with educators who rated themselves as advanced computer users ($p<0.05$).

In addition, there seems to be a strong negative relationship between educators who have rated themselves as advanced computer users when compared with educators who have rated themselves as beginners of computer usage ($p<0.05$).

Table 6.64 depicts the differences between the educators' computer expertise and their negative theories and beliefs about the use of computers in schools.

Table 6.64 Differences regarding educators' computer expertise in terms of negative theories and beliefs

Dependent Variable	(I) Recode Level of Expertise	(J) Recode Level of Expertise	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval Low.Bound	95% Confidence Interval Up.Bound
Negative theories and beliefs	Beginner	Average	**4.21986***	.65120	.000	2.6229	5.8168
		Advanced	**8.90579***	.72848	.000	7.1193	10.6922
	Average	Beginner	**-4.21986***	.65120	.000	-5.8168	-2.6229
		Advanced	**4.68593***	.61112	.000	3.1873	6.1846
	Advanced	Beginner	**-8.90579***	.72848	.000	-10.6922	-7.1193
		Average	**-4.68593***	.61112	.000	-6.1846	-3.1873

*. The mean difference is significant at the 0.05 level.

It is reported in Table 6.64 that when educator negative theories and beliefs towards computers are compared with the educators' level of computer expertise, the scores indicate that there are significant differences between the highlighted variables. The significant difference is between educators who rated themselves as beginners with respect to the various levels of computer usage compared with educators who rated themselves as advanced computer users ($p<0.05$).In addition, there seems to be a strong negative relationship between educators who have rated themselves as advanced computer users when compared with educators who have rated themselves as beginners of computer usage ($p<0.05$). Table 6.65 portrays the differences between the educators' computer expertise and support.

Table 6.65 Differences regarding educators' computer expertise in terms of collegial support

Dependent Variable	(I) Recode Level of Expertise	(J) Recode Level of Expertise	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval Low. Bound	95% Confidence Interval Up.Bound
Educator support factor 2 (collegial)	Beginner	Average	.29727	.20515	.350	-.2058	.8004
		Advanced	**.56429***	.22950	.049	.0015	1.1271
	Advanced	Beginner	**-.56429***	.22950	.049	-1.1271	-.0015
		Average	-.26702	.19252	.383	-.7391	.2051

*. The mean difference is significant at the 0.05 level.

It is reported in Table 6.65 that when educator collegial support is compared with the educators' level of computer expertise, the scores indicate that there are significant differences between the highlighted variables. The significant difference is between educators who rated themselves as beginners with respect to the various levels of computer usage compared with educators who rated themselves as advanced computer users ($p<0.05$).

In addition, there seems to be a strong negative relationship between educators who have rated themselves as advanced computer users when compared with educators who have rated themselves as beginners of computer usage ($p<0.05$).

Table 6.66 presents the differences between the educators' computer expertise and the sub-dimension, function, in the dependent variable.

Table 6.66 Differences regarding educators' computer expertise in terms of function in dependent variable

Dependent Variable	(I) Recode Level of Expertise	(J) Recode Level of Expertise	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval Low.Bound	95% Confidence Interval Up.Bound
Educator use of computers factor 1 (function)	Beginner	Average	**-8.39855***	.70376	.000	-10.1244	-6.6727
		Advanced	**-18.51380***	.78728	.000	-20.4444	-16.5832
	Average	Beginner	**8.39855***	.70376	.000	6.6727	10.1244
		Advanced	**-10.11525***	.66044	.000	-11.7348	-8.4957
	Advanced	Beginner	**18.51380***	.78728	.000	16.5832	20.4444
		Average	**10.11525***	.66044	.000	8.4957	11.7348

*. The mean difference is significant at the 0.05 level.

It is reported in Table 6.66 that when functionality in the dependent variable is compared with the educators' level of computer expertise, the scores indicate that there are significant differences between the highlighted variables.

The significant difference is between educators who rated themselves as advanced computer users with respect to the various levels in computer usage compared with educators who rated themselves as beginners in computer usage ($p<0.05$).

In addition, there seems to be a strong negative relationship between educators who have rated themselves as beginners in computer usage when compared with educators who have rated themselves as advanced computer users (p<0.05).

Table 6.67 illustrates the differences between the educators' computer expertise and the sub-dimension, procedures, in the dependent variable

Table 6.67 Differences regarding educators' computer expertise in terms of procedures in dependent variable

Dependent Variable	(I) Recode Level of Expertise	(J) Recode Level of Expertise	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval Low.Bound	95% Confidence Interval Up.Bound
Educator use of computers factor 2 (procedures)	Beginner	Average	**-4.47097***	.30790	.000	-5.2260	-3.7159
		Advanced	**-6.56875***	.34444	.000	-7.4134	-5.7241
	Average	Beginner	**4.47097***	.30790	.000	3.7159	5.2260
		Advanced	**-2.09778***	.28895	.000	-2.8064	-1.3892
	Advanced	Beginner	**6.56875***	.34444	.000	5.7241	7.4134
		Average	**2.09778***	.28895	.000	1.3892	2.8064

*. The mean difference is significant at the 0.05 level.

It is reported in Table 6.67 that when procedures in the dependent variable are compared with the educators' level of computer expertise, the scores indicate that there are significant differences between the highlighted variables.

The significant difference is between educators who rated themselves as advanced computer users with respect to the various levels in computer usage compared with educators who rated themselves as beginners in computer usage (p<0.05).

In addition, there seems to be a strong negative relationship between educators who have rated themselves as beginners in computer usage when compared with educators who have rated themselves as advanced computer users (p<0.05).

Table 6.68 depicts differences between the educators' computer expertise and the dependent variable.

Table 6.68 Differences regarding educators' computer expertise in terms of a two-factor solution in the dependent variable

Dependent Variable	(I) Recode Level of Expertise	(J) Recode Level of Expertise	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval Low.Bound	95% Confidence Interval Up.Bound
Educator use of computers (2 factor solution total) dv	Beginner	Average	**-12.86952***	.89154	.000	-15.0558	-10.6832
		Advanced	**-25.08255***	.99734	.000	-27.5283	-22.6368
	Average	Beginner	**12.86952***	.89154	.000	10.6832	15.0558
		Advanced	**-12.21303***	.83666	.000	-14.2648	-10.1613
	Advanced	Beginner	**25.08255***	.99734	.000	22.6368	27.5283
		Average	**12.21303***	.83666	.000	10.1613	14.2648

*. The mean difference is significant at the 0.05 level.

It is reported in Table 6.68 that when the dependent variable is compared with the educators' level of computer expertise, the scores indicate that there are significant differences between the highlighted variables. The biggest significant difference is between educators who rated themselves as advanced computer users with respect to the various levels in computer usage compared with educators who rated themselves as beginners in computer usage ($p<0.05$).

In addition, there seems to be a strong negative relationship between educators who have rated themselves as beginners in computer usage when compared with educators who have rated themselves as advanced computer users ($p<0.05$).

In summary, the Multiple Comparisons between the variables provided evidence that there are significant differences in the groups being compared. Groups that have significant differences have been highlighted and discussions on the differences will continue in the following chapter.

Furthermore, associations were sought between all the independent variables including the sub-dimensions and the instructional methods used by computing Multiple Comparisons using Post Hoc Analysis. The results that were significant are presented below and the complete report is appended as Appendix G.

6.18.4 Instructional methods

Table 6.69 portrays the differences among the educators' instructional methods of lesson delivery and the consequences of using computers.

Table 6.69 Differences among instructional methods used in terms of consequence of using computers

Dependent Variable	(I) Recode Instructional Method Used	(J) Recode Instructional Method Used	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval Lower Bound	95% Confidence Interval Upper Bound
Training consequence of using computers	Largely teacher-directed (e.g., teacher-led discussion, lecture)	Even-balance between teacher-directed and student-centred activities	**-1.74802***	.66652	.033	-3.3832	-.1129
	Even-balance between teacher-directed and student-centred activities	Largely teacher-directed (e.g., teacher-led discussion, lecture)	**1.74802***	.66652	.033	.1129	3.3832

*. The mean difference is significant at the 0.05 level.

It is reported in Table 6.69 that when the consequences of educators' training are compared with the educators' instructional method used in the classroom, the scores indicate a significant difference between the highlighted variables.

The significant difference is evenly balanced between teacher-directed and student-centred activities when compared with largely teacher-directed instruction ($p<0.05$).

Table 6.70 presents the differences among the educators' instructional methods of lesson delivery and their pedagogical confidence in using computers.

Table 6.70 Differences among instructional methods used in terms of pedagogy confidence

Dependent Variable	(I) Recode Instructional Method Used	(J) Recode Instructional Method Used	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval Lower Bound	95% Confidence Interval Upper Bound
Educator pedagogy (confidence)	Largely teacher-directed (e.g., teacher-led discussion, lecture)	Even-balance between teacher-directed and student-centred activities	**-2.04268***	.68248	.012	-3.7167	-.3686
	Even-balance between teacher-directed and student-centred activities	Largely teacher-directed (e.g., teacher-led discussion, lecture)	**2.04268***	.68248	.012	.3686	3.7167

*. The mean difference is significant at the 0.05 level.

It is reported in Table 6.70 that when the confidence of educator pedagogy is compared with the educators' instructional method used in the classroom, the scores indicate that there is a significant difference between the highlighted variables. The significant difference is evenly balanced between teacher-directed and student-centred activities when these are compared with largely teacher-directed instruction ($p<0.05$).

In summary, the Multiple Comparisons between the variables have provided evidence that there are significant differences in the groups being compared. Groups that have significant differences have been highlighted and discussions on the differences will continue in Chapter Eight.

In order to examine whether there are any differences between gender and the independent variables, *t*-test statistics were calculated with the group means, group standard deviations, *t*-values and significance (p) values. The results of these analyses are illustrated in Table 6.71 below.

Table 6.71 T-test comparing independent variables with gender

Variable	Gender	N	Mean	Std. Dev	t value	Sig. (2-tailed)
Educator Theories and Beliefs (Total)	Male	341	49.9971	10.04036		
	Female	471	51.3928	10.32353	-1.923	.055
Frequency of Access To Computers (Total)	Male	341	18.8152	5.22082		
	Female	471	18.7261	5.53359	.232	.817
Problems Associated With Access To Computers (Total)	Male	341	19.7507	5.81575		
	Female	471	18.9894	6.53582	1.715	.087
Educator's Attitude Towards Computers (Total)	Male	341	14.8856	4.39670		
	Female	471	15.9406	4.64262	-3.267	**.001**
Educator Support Using Computers (2F Solution Total)	Male	341	29.0645	5.79873		
	Female	471	29.3270	6.08550	-.619	.536
Consequences of Using Computers (Total)	Male	322	34.1149	6.35667		
	Female	441	33.0975	6.68424	2.120	**.034**
Value of Computer Training (Total)	Male	341	27.6686	5.10350		
	Female	471	27.6879	4.87528	-.055	.957
Importance of Computer Training (Total)	Male	334	21.7485	5.05848		
	Female	453	21.7881	4.51929	-.115	.908
Educator Pedagogy (Total)	Male	341	72.4135	11.69046		
	Female	471	71.1677	11.44234	1.517	.130
Educator Pedagogy_F1 (Importance)	Male	341	26.6716	5.11952		
	Female	471	26.7134	4.88687	-.118	.906
Educator Pedagogy_F2 (Confidence)	Male	341	24.6070	7.20362		**.010**
	Female	471	23.2972	7.01676	2.596	
Educator Pedagogy_F3 (Productivity)	Male	341	21.1349	2.74815		
	Female	471	21.1571	2.95584	-.109	913
Negative Attitude Towards Computers	Male	341	19.9677	6.00359		
	Female	471	20.6454	5.98718	-1.590	.112

Variable	Gender	N	Mean	Std. Dev	t value	Sig. (2-tailed)
Positive Attitude Towards Computers	Male	341	12.5572	3.55384		
	Female	471	13.3631	3.92670	-3.003	**.003**
Positive Theories and Beliefs	Male	341	16.2375	4.42644		
	Female	471	16.3609	4.38242	-.394	.693
Negative Theories and Beliefs	Male	341	33.7595	7.87854		
	Female	471	35.0318	8.01575	-2.248	**.025**
Educator Support F1 (Admin Support)	Male	341	17.7449	4.60716		
	Female	471	18.0467	4.83273	-.896	.371
Educator Support F2 (Collegial Support)	Male	341	11.3196	2.25059		
	Female	471	11.2803	2.36419	.239	.811
Educator use of computers F1 (Functionality)	Male	341	29.0499	10.58052		
	Female	471	26.4289	9.97095	3.603	**.000**
Educator use of computers F2 (Procedures)	Male	341	21.5337	4.21303		
	Female	471	21.3567	4.17950	.594	.553
Educator use of computers (2F Solution Total) DV	Male	341	50.5836	13.69853		
	Female	471	47.7856	13.05303	2.953	**.003**

Table 6.71 shows that females differed significantly from males in terms of the educators' attitude towards computers. In addition, it shows that males differed significantly from females in terms of the consequences of using computers.

When emphasising the sub-dimensions, males differed significantly from females in terms of one-factor solutions in the dependent variable; while males differed significantly from females on their confidence level of educator pedagogy. Females differed significantly from males in terms of their positive attitudes towards computers; females differed significantly from males on negative theories and beliefs; while males differed significantly from females on the functionality factor in the dependent variable. For the total solution in regard to the dependent variable, males differed significantly from females.

6.19 Summary

Chapter 6 has presented the statistical findings of the study based on the research questions. For each of these questions, statistical analyses were presented in terms of descriptive, explanatory, predictive and inferential statistics. Statistical results have suggested that the theoretical model depicting the educators' use of computer utilisation in the classroom has acceptable levels of fit, with some significant beta coefficients between the independent variables.

Significant differences were found relating to age, where the majority of the educators (39.4%) were in the 40-49 year age group. It also found that most of the educators in the age group 20-49 years provided the highest level of representation of the sample. Differences were found in gender where females represented 58% of the sample. In addition, differences were found in educational qualifications, teaching experience, computer experience, instructional methods and the level of computer expertise. These issues will all be discussed in the following chapter.

The next chapter will discuss the findings of the principals' questionnaire that are qualitative in nature.

CHAPTER 7

RESULTS OF THE QUALITATIVE SURVEY AMONGST PRINCIPALS

7.1 Introduction

It has been argued that the principal has become increasingly important in schools and has always been the gatekeeper of change. In many instances, the principal often decides the fate of innovations coming from the education department or from the educator. According to Fullan (2001, p.59), it is now necessary for principals to lead change or innovation in their schools and thus “they have become a critical source of initiation”.

Therefore, it is important for the principal to be organised and efficient in leading the process of adopting the use of computers in schools. Principals of schools use computers to assist them in their administrative and managerial duties. The promotion and support from the principal regarding the use of computers in schools depend on how useful the principal considers computers to be (Schiller, 2003).

Due to the above-mentioned importance of the principal, a qualitative investigation was initiated to establish the role that the principals play in the use of computers in their schools. Chapter 7 presents the findings of the qualitative data collected from thirty-two questionnaires completed by the principals of various schools in the Western Cape central metropole and discusses the attitudes and views of secondary school principals regarding the importance of the use of computers, the ICT policy, computer resources and other factors related to the use of computers in schools.

Content analysis was used to analyse the data with the intent to identify the major themes and to get a sense of the ‘why’ and ‘how’ principals relate to the use of computers in their schools. These data were also necessary to supplement the quantitative data.

7.2 Research findings – biographical information on the principals

As discussed in Chapter 5, the participants in this section of the study were exclusively principals of secondary schools.

Although 60 schools were initially targeted, only 32 principals (a response rate of 53.33%) completed the questionnaire.

7.2.1 Gender

It was necessary to establish the gender of the participants. This information was considered useful for comparisons, and possibly for future research. The analyses of the data revealed that seven female principals (21.87%) and twenty-five male principals (78.12%) had completed the questionnaire.

7.2.2 Age

Principals were asked to indicate their age range. Although the literature strongly suggests that there is no correlation between age and the use of computers (Jones, 2004; Selwyn and Facer, 2007), this study suggests that younger educators who have recently graduated might have had more exposure to computer technology than their older colleagues might possibly have had.

The analysis of the data indicated that there were 14 principals in the 40-49-year age group (43.74%), 15 principals in the 50–59-year age group (46.87%), and 3 only in the 60-years and above age group (9.37%).

7.2.3 Educational qualification

The questionnaire asked principals to state their highest educational qualification. The findings indicated that 25 principals had a Bachelor's degree (78.12%); four had a Master's degree (12.5%), while three had only teaching diplomas (9.37%).

7.2.4 Teaching experience

The principals were requested to indicate the number of years' experience in teaching. This information was important because it could affect the principals' confidence and competency. The findings revealed that 29 principals had had 21 years or more teaching experience (90.62%), while three had had between 16 and 20 years of teaching experience (9.37%).

7.2.5 Computer experience

The principals were asked how many years they had been using computers, while performing their duties as educators. Table 7.1 presents the school principals' years of computer experience.

Table 7.1 Computer experience

Principals' computer experience		
Years	**Frequency**	**Percent**
Less than 1 year	4	12.5
1-3	7	21.9
4-6	7	21.9
7-10	3	9.4
11 years or more	11	34.4
Totals	**32**	**100**

While only four principals were somewhat experienced in the use of computers (for less than one year), 17 secondary schools had a principal who had computer experience of between one and ten years, and a further 11 principals had computer experience of more than 11 years.

7.2.6 Number of teaching staff

The principals were asked to indicate the number of educators employed in their schools. The results indicated that on average schools had between 30 and 35 educators per school.

The above section has painted a brief picture of the secondary school principals who formed part of the overall investigation. The next section discusses the main research findings.

7.3 Main research findings and discussion

7.3.1 Policy on the use of computers

School principals were asked whether they had a written policy on the use of computers in their schools. This line of inquiry aimed to identify the relationship between the existence and understanding of a policy and the extent to which the school actively encouraged computer use by its educators. The findings revealed that 81.25% of principals had a policy, while 18.75% of principals did not.

According to Pelgrum and Plomp (1991), school principals are important change agents due to the nature of the position they hold in the school. Moreover, these scholars profess that the attitude of the principal towards computers plays a significant role in the successful implementation of computers in schools. Most of the principals had copies of the policy document stored in the principal's office. Furthermore, the majority of principals were aware of the contents of the policy document.

In order to get a deeper sense of how the principal was using the document in order to promote the use of computers in their schools an open-ended question on the 'essence' of the policy was further asked. The responses from the principals are summarised below and limited to those who replied "yes", they had an ICT policy.

Furthermore, responses have been arranged in groups throughout this chapter to overcome the excessive use of direct quotations. The policy is believed to be about:

- Having computer literate learners at school;
- Having all educators' instruction presented through the use of computers;
- Focusing on the delivery of only maths and science in the curriculum;
- Rules around the use of computers being effective, and making the optimal use of existing computers;
- Using computers to enhance teaching and learning generally; and
- Improving the overall effectiveness of schools.

It could be stated that principals have a good understanding of what the policy comprises.

It seemed that the principals were eager to use computers in their schools; however, the necessary drive and enthusiasm was lacking. A few principals stated that their ICT policy could be viewed as doing no more than fulfilling the needs of the curriculum. There were six principals who did not have any ICT policy in their schools.

Their responses for not having a policy were that although the administration had provided an ICT policy for all government schools, they were only using computers as an administrative tool. In other words, a policy is necessary only if computers are to be used for instructional purposes. Furthermore, they stated that it was good to have a policy in place, but the support and funds from the education department were insufficient to support the implementation of the ICT policy.

A few of these principals confirmed that the implementation of the ICT policy was falling behind. In addition, principals mentioned that the ICT policy was "*an incomplete plan*", consisting merely of goals, and that there was *"no strategy in place*" to achieve the goals of the policy.

Another reason for the absence of an ICT policy in these six schools could be related to how important the principals regard the use of computers to be in teaching. A principal from school 27, one of the six schools that did not have an existing policy, reported that they had *"never had an ICT committee and one was recently established"*. This suggests that this principal was cognisant of the importance of computers, and was making some progress towards introducing the use of computers.

Generally, the remaining five principals did not see the need to implement computers in their schools. They were happy that their educators were only using them for administrative purposes. During the interviews, it was evident that some principals had not forced their educators to use computers in their lessons: "*I cannot force my educators to use computers in their teaching*...'' [Principal/School 27]. The latter implies that the increased use of computers in these five schools will largely depend on the educators.

In addition, the principals agreed that the education department was striving to ensure that all public schools were using computers in their schools, but the degree of integration still rests, in the final analysis, with the principals and their educators.

7.3.2 Priority attached to the use of computers

Principals were also asked to state the level of priority they attached to computers as an additional medium through which learners could be taught. They were requested to indicate whether this was a high, average or low priority issue for their respective schools. Twenty-one principals responded that they placed a high priority on the implementation of computers.

Some of the common reasons for choosing this level of priority were:

- Computers are the future;
- WCED has made computers compulsory in the curriculum;
- The use of computers empowers the learner and educator; and
- To be computer illiterate in the post-modern information age is to be illiterate.

Expanding on the points above, principals reported that computers are now being integrated into many subjects of the curriculum - such as mathematics, science and geography. Because many of these schools relied on outside support from parents and small businesses it was stated to be a high priority issue because principals were of the view that using computers empowered all the relevant stakeholders.

Principals were particularly motivated because they wanted their schools to be seen as keeping up with the latest trends in teaching and not just in technology as such. In addition, using computers encouraged their educators to use this new way to teach as being part of the curriculum. Principals were concerned that some learners had no access to computers away from school. Thus, computers as an additional medium through which learners could learn were seen to be a high priority for principals. Principals believed that access to computers was seen to be extremely important because many learners did their research with the use of a computer.

Eight principals indicated that they placed an average priority on the use of computers as an additional medium through which learners could be taught. Some of their reasons included:

- Computers are seen as a teaching aid, as a teaching tool and as an accompaniment to teaching (i.e. tutor);
- The modern focus is on human resources and library facilities;
- Computers are a new learning experience opportunity;
- Not all educators have the expertise to teach with computers; and
- There are insufficient computers to serve all educators and learners.

It may be argued these eight principals' reasons for having only an average priority could be due to infrastructural or logistical problems. In many of these schools, access to computers was problematic due to hardware and software issues. Information gleaned from the interviews revealed that it took a while for the administration to deal with computer repairs.

Principals strongly believe that although their educators are receiving the required training, the skills were not being used in the classroom. Furthermore, those principals who placed an average priority on computers indicated that their focus was on dealing with human resource issues and trying to equip their library facilities instead. This suggests that these schools were really struggling and had limited financial resources to invest in computers.

Moreover, from the responses, it was noted that computers were merely seen as a teaching aid and added to the educators' workload. It was found, through a discussion with the principal of school 6 that educators in that school did not require the use of computers to teach the whole lesson. Educators required the computer only when a certain aspect of the lesson needed to be explained. For example, during a science lesson, the melting of the ice caps in Antarctica was explained and visuals of the actual melting taking place could be observed repeatedly.

Only three principals indicated a low priority for this issue, because they were yet to see proven success using computers in their schools.

In addition, they argued that computers were expensive and that they lacked the human and financial capital to maintain the computers. The low priority on computer use could also be attributed to the influence that some educators have on the principals in their beliefs and attitudes towards their experiences in using computers for teaching.

Considering the above discussions, principals who wish to foster the use of computers in their schools would need to take an active role, rather than sitting with folded hands.

7.3.3 Responsibility for computer maintenance

The qualitative investigation also looked at where the responsibility lies for the maintenance and purchasing of computers for schools. The findings suggest that the responsibility rests in two camps – it is the joint responsibility of the school and the WCED. Only one response indicated that it was the sole responsibility of the school.

The first position of principals who indicated that it was the WCED's responsibility indicated that they were serving schools in poor communities. Moreover, the principals lamented that most of their learners' parents were unemployed, resulting in many learners not even paying any school fees. Therefore, these principals firmly believed that the WCED must become more involved in maintaining the computer equipment.

Many principals stated that their schools were public schools and all educational initiatives and innovations must be funded by the State. One principal stated that the schools fees had increased year on year, and parents had become excessively burdened with school fees.

The second situation of joint responsibility between the schools and WCED occurred when the principals raised funds for the school and a portion was set aside for computer maintenance.

However, due to budget constraints, funds allocated to computer maintenance were frequently used for school maintenance, and to pay salaries for additional teaching staff.

Importantly, principals lamented that the continuous use of computers required ongoing maintenance, and the school had no budget for these expenses. What was repeatedly being mentioned was that the Khanya project had provided the computer laboratories. However, the maintenance costs were high in keeping the computers in working order. A few principals indicated that they depended on the services of parents who were working in the information technology field to service their computers at no cost to the school.

Some of the reasons why principals questioned who should be responsible for computers in schools and why their schools could not afford this expense have been summarised below.

- The school fees, fundraising, norms and standards do not make provision for computer maintenance;
- Schools are located in disadvantaged areas;
- The community surrounding the school cannot afford computers; and
- Given that the schools investigated are government schools, computers and maintenance should be supplied by the government.

Further insights from a few principals indicated that the WCED has made the use of computers compulsory in the curriculum. Therefore, principals strongly believed the WCED should continuously monitor the use of computers in public schools. Accordingly, principals would like the WCED to liaise with the Khanya project team to ensure that computers in their schools were maintained and properly supported.

A case in point is that schools are struggling to maintain computers by themselves due to insufficient funds. A principal from school 24 stated that: "*it has been many months before they could network their computers because of the costs*".

A supporting factor in the computer maintenance context that surfaced in the principals' interviews was that many principals have identified an educator in their school to be the appointed person with regard to all computer matters. This educator would then liaise with the WCED or the Khanya team to ensure that the school's computers were in working order.

A similar arrangement was found in the Martin and others (2004, p.2) study, where the schools appointed a "Master Teacher" to attend to all computer related issues. Additionally, these master teachers would then meet on a regular basis to learn from each other and share experiences.

7.3.4 Extent of computer usage

Principals were asked whether the computers in their schools were used to their maximum capacity. Twenty principals indicated that the computers were used to their maximum capacity. The findings suggest that they had been used to their fullest extent - mainly because computers are included as part of the curriculum and can be used constructively to enhance the teaching in a number of subjects.

Moreover, the educators in those schools that have sufficient access to computer resources were using them to do their administrative work as well. It was found that in some schools resources were limited and spread thinly among a number of learners; and the computer laboratory was always occupied. This finding implies that schools have limited computer resources, because the computer laboratory is used around the clock and is never empty. In addition, principals reported that learners are using the computer laboratories even after school hours for research purposes, confirming that the computer laboratories are being used to their maximum capacity.

Some of the reasons why computer laboratories have been used to their maximum capacity are summarised below:

- Computers are used for a wide range of learning tasks;
- A timetable is drawn up, indicating when educators are taking learners to the laboratory;
- Learner and educator usage is optimal;
- A fully booked timetable: there are some learning areas beyond maths and science; and
- Educators use computers for different tasks.

Twelve principals indicated that computers in their schools were not being used to their fullest capacity even though they had placed a high priority on them.

This is an important finding, since for the majority of principals practical constraints, educator attitudes, financial issues and educator beliefs have caused the computer laboratory to be underutilised in their schools. Interestingly, out of the twelve, one response came from a very affluent school.

Six reasons are attributed to the underutilisation of computer laboratories. These include:

- Educators' workload is too heavy;
- A lack of training and of confidence on the part of educators;
- Timetable clashes;
- Human resources shortage; and
- Some educators are unsure how to improve on their computer skills.

Some suggestions can be drawn from the above discussion. Practical constraints and educator attitudes seem to have an impact on the effective use of computers in schools. The practical constraints have to do with the huge teaching workloads and the extramural activities that educators have to attend.

When it comes to attitudes, there are apparently a few educators who have developed negative attitudes towards the use of computers; and they tend to refrain from using computers.

Principals also stated that when educators lacked the basic computer skills, educators were inclined to keep away from the computer laboratory, in fear of damaging something.

7.3.5 Enhancement of learning

Principals were asked whether computers, when used for instructional purposes, enhance learning. This question was posed because it is important to understand the views of the principals, since they are seen as change agents in schools (Fullan, 2001). In addition, principals stated that as the learners become more involved in using computers in their work, the educators gradually become more interested as well, thereby forcing the educators to improve their own computer skills.

It is evident that most of the principals had high opinions on the use of computers in enhancing the learning process in their schools. The majority agreed that that the use of computers for instructional purposes enhances learning. A few reasons are listed below:

- Learners tend to be visual learners;
- There is more electronic learning material that has become available;
- Computers are a means of providing quick information to learners; and
- A wealth of relevant educational information is readily available.
- Furthermore, some illustrations cannot easily be replicated on a chalkboard.

However, two principals slightly disagreed on the issue of computers enhancing the learning process.

Their reasons were based on the perceptions of the educators who taught in their schools. These schools were largely influenced by a lack of computer resources and finances, and were located in poor areas. However, they believed that some of their educators thought that the use of computers had no effect on their teaching styles.

The Martin and others (2004) study found similar results and stated that when educators have classroom computers, the chances of the educators using computers during their lessons would be much higher. As a solution, one principal suggested that by providing practical training and easy-to-use computer programs, educators in their schools would be able overcome this belief.

This perception is in line with a recent study which found that there are educators who are of the opinion that the benefits of using computers in education still remain unclear (Chigona and Chigona, 2010).

7.3.6 Sufficient technical support for educators

Principals were asked whether their schools provided any form of technical support for their educators. The reason for this question was that many educators lacked technical support when using computers, and when things went wrong, they did not know what to do (Jones, 2004; Scrimshaw, 2004). Twenty-four principals indicated that they did have some form of support.

Support came from parents who were experts in the information technology sector and offered their service at no cost to the schools. In addition, most schools had the service of a computer technician. It was found - especially in poorer schools that were located in close proximity - that the same computer technician was used and the costs were shared. Moreover, principals stated that there was an urgent need for a permanent computer support person dedicated to this function. They could not afford to have computer interruptions during lessons.

A school principal commenting on computer support replied: "*yes, important for immediate service, therefore no backlog and postponement of activities*" [Principal/School15].

Most principals argue that the lack of computer technical support has an effect on the level of enthusiasm and sometimes demotivates the educators in using computers.

As past educators themselves, many principals expressed the feeling that they would seldom be able to get through their lessons due to faulty computers. This would cause them to revert to chalk and board.

Many principals stated that they sometimes found themselves in invidious positions justifying the remuneration of the technicians when, in fact, more educators are desperately required to teach in their schools.

Moreover, principals generally stated that they employed outsourced computer services to assist them with computer problems because the required skills rarely exist amongst the educators in their schools.

Eight principals responded that they had no technical support in their schools. They raised issues such as the WCED being too slow to respond to their problems. Consequently, they attempted to repair the faults themselves. Some educators in these schools were found to have a modicum of expertise in repairing computers. If the fault was too complicated for the educator to repair, then the school would contact a private computer company to undertake the repair; and they (the school) would cover the costs themselves.

7.3.7 Computer courses and training

Principals were asked whether they had organised any computer courses or workshops for their educators. The reason for this question was to investigate whether the principal was taking an active role to ensure that the educators in their schools had the opportunity to improve on their computer skills. There were mixed responses to this question and no clear patterns emerged.

Surprisingly, there were approximately nine schools that reported that computer training was very 'rare'. Some principals referred to training as only being offered by Khanya.

It seems that educator workloads do influence the frequency of training and the question arises whether Khanya in conjunction with the WCED should provide additional training - or should the schools consider other training sources.

The latter seems unlikely because these schools would not be able to afford training elsewhere. Many principals argue that training should be tackled with a bottom-up approach, whereby the educator makes a request for training, and not, as is presently the case, a top-down approach from Khanya who decide when they want to provide the training.

Comments from principals indicated that educators' teaching loads are huge and if Khanya offers training, then such training must be provided in consultation with the educators regarding their workloads and specific training needs.

Twenty-one principals responded that it was mandatory for educators to receive the training that was offered by the Khanya project. In addition, it is part of the schools ICT policy document that computer training is compulsory.

However, there were some principals (n=11) who indicated that it was inappropriate to make training compulsory because of the educators' workloads. Despite the perceived high workloads of the educators, secondary school principals will have to encourage their educators to go on these courses, otherwise these educators will fall behind.

Educators need ongoing training and support; and the mistake is often made that educators believe once-off training is sufficient. The latter is supported by Martin and others (2004, p.5) who argues that once-off training most often leaves the educator "frustrated because it does not provide them with the chance to think through, explore and reinforce the concepts being covered'.

7.4 Khanya project

Principals were asked about the Khanya project and its success. The majority of principals (n=19 or 59.37%) responded that it was successful; and eight principals rated the project as being of average success (25%), while three rated it as having limited success (9.37%). Two principals chose not to answer this question (6.25%). Furthermore, principals believed that the project was successful because Khanya had provided the computer laboratories.

Some principals lamented that it depended entirely on the attitudes and beliefs of their educators towards harnessing the benefits of computers in their teaching.

Principals strongly believed that if their educators were not properly trained and enthusiastic about the use of computers, then the Khanya project would not be very successful.

Therefore, principals of most schools are of the view that it is not only the WCED's responsibility to ensure that all educators are using computers in their instruction, but the schools' responsibility as well. In addition, principals confirmed that although they had provided the collegial support and motivation to encourage their educators to use computers, the WCED must devise alternate plans such as organised teaching relief, which would get the educators to buy in as well.

In a similar vein, principals who responded to average and limited success of the Khanya project contended that Khanya had introduced computers into the schools, installed the computer laboratories and they were therefore favourably 'locked' in. Notwithstanding this, the principals concurred that computer maintenance is a challenge: "*Khanya set up the labs and installs the computers, provides training and is gone …then what*?" [Principal/School 23].

The pattern that emerges is that principals are struggling with their own duties and cannot devote all their attention to computer-related issues in their schools. Again, principals stated that the implementation of computers in their schools must be a joint responsibility between the schools, the educators, Khanya and the WCED in order to make the envisaged impact.

7.5 Enhancement of the teaching experience

Principals were asked to elaborate on factors that could enhance the teaching experience of educators when using computers for instructional purposes in their classrooms.

A common trend indicated that training should be intensified, thereby increasing the educators' confidence and skills in the use of computers. Many principals believed that additional support from the education department is required, showcasing in particular how computers can assist educators in their jobs rather than be a burden to them.

In addition, principals stated that most of their educators who attended training courses, could not find the time to practise their newly acquired skills.

Furthermore, principals were aware of the large classes, additional workloads and the extramural activities that were taking up most of the educators' time. At least three principals suggested that the only way for a more successful rate of using computers in classrooms, is that each school must have a dedicated person (Master Teacher) for this job. They stressed that the sole responsibility of this person should be to co-ordinate the complete suite of technological change in the school.

7.6 Summary

One of the objectives of this study has been to investigate the role played by the principals regarding the use of computers in their schools. The findings have indicated that principals strongly believed computers should never replace the importance and value placed on the educators themselves. The role model position of an educator in the classroom is critical, especially to those learners who come from poor backgrounds.

The support from the principal - or a lack thereof - may be considered as the most important aspect in the use of computers in schools. Principals profess that the purchasing, maintenance and support of computers constitute their biggest constraints.

Principals would like to see that educators have regular training sessions in their school computer laboratories, relating specifically to the subjects the educators are teaching. By doing so, it is hoped that this would introduce spontaneity in the use of computers in teaching and learning and breaking the monotony of 'chalk and board'.

There seems to be a generational issue here. It is expected that the older educators will show some resistance to computers. A few principals agreed that computers are an alternative way of presenting lessons in the classrooms. However, they stated that there will always be some resistance from a few educators to the use of computers, but it is up to the school and the WCED to make the most of computers in secondary schools.

Regarding the ICT policy issues, principals argue that schools are required to implement every policy and technological innovation that the educational department decides on. Principals agreed that these innovations may look innovative from a distance, but in some instances they become meaningless in practice, especially if there is no support or follow-through. These remarks by principals are reminiscent of the words of Fullan (2001, p.21) in '*The new meaning of Educational Change'*, that "the goal is to appreciate the necessity and richness of external knowledge, but not to become victimised by it".

In the next chapter, the researcher will present a discussion of the study undertaken, together with the conclusions drawn and some recommendations.

CHAPTER 8

DISCUSSION, CONCLUSION AND RECOMMENDATIONS

8.1 Introduction

In Chapter 8 the researcher will discuss the important findings and conclusions of the research. Recommendations for improvement and further research will be made towards the end of this chapter. The conclusions will be supported by the literature review and the findings from the questionnaire surveys presented in the preceding chapters.

The purpose of this study was to investigate which factors influenced secondary school educators in the Western Cape central metropole to use computers in their instruction and then based on the findings, to develop a proposed model or a framework that could ensure an increased/improved or successful use of computers in schools.

This study has provided evidence that computers are indeed being used for instructional purposes in schools of the Western Cape central metropole – but only to a limited extent.

This chapter begins by providing a brief summary of the preceding seven chapters followed by the main findings of the study. Thereafter, the chapter addresses the research questions posed by this study and discusses the conclusions and implications of the results.

8.2 Chapter summary

Chapter One provided insights into the main research problem and the objective of this study. It included a review of the literature on the use of computers in education. In addition, it discussed the significance of the study, the various educational programs used in South African schools, related studies, the research design and an exposition of the chapters.

Chapter Two presented a discussion on the various theories to do with the use of computers in teaching and learning. This concerned the technological theories, such as the theory of reasoned action, the theory of planned behaviour, the technology-acceptance models (one and two), and the unified theory of acceptance. The educational theories comprised the problem-solving model, the social-interaction model, the research, development and diffusion models and the linkage model. The chapter also introduced Rogers' diffusion of innovation theory, which provided the theoretical framework for this study.

Chapter Three presented a review of the literature pertaining to the use of computers in education which has refined the focus of the study on the factors investigated. The variables used in this study were thus extracted from an extensive review of the literature and included educators' theories and beliefs, access to computers, educators' attitudes towards computers, support, training and pedagogy. In addition, the literature provided evidence on the value of computers as an instructional tool in education.

Chapter Four discussed the implications of effective teaching and the use of educational technologies in education in particular at the hand of Rogers' Diffusion of Innovation theory was extensively discussed. Furthermore, additional factors relating to the effective use of computers in schools were discussed. The variables that were used in this research were highlighted and linked to the supporting literature.

Chapter Five explained the methods and rigour employed in collecting the quantitative data. It included data-collection procedures, sample size, the pilot study and the analyses of the data. Statistical techniques, such as multiple regressions, correlations, ANOVA, T-tests, exploratory and confirmatory-factor analysis were all used to test the data. In addition, Chapter five briefly included a discussion of the qualitative data collection procedure from the secondary school principals.

Chapter Six presented the purification and the analyses of the data. It provided support for the various statistical analyses and techniques used to analyse the data. Only the significant findings were reported.

Chapter Seven provided information on the qualitative questionnaire, which was completed by the principals of the schools. Issues such as computer policy implementation, support and training were similarly addressed. This information provided support to the quantitative questionnaire, which was completed by the educators.

Finally, Chapter Eight provided a review of the chapters in this study, a discussion of the main findings, the limitations, the recommendations, some suggestions for further research and the conclusion.

The following section presents the findings, which were guided by the seven research questions of this study. Each research question will be stated once more, and a discussion thereof will follow. In addition, descriptive statistics and multiple-regression analysis were used to identify the secondary school educators' personal attitudes, employment, qualifications, teaching experience and their varying levels of computer usage. These results will be integrated in the following section.

8.3 Discussion on the educators' biographical information

This study investigated the secondary school educators' personal characteristics to establish whether there were any differences in the ways in which the educators used computers as teaching tools in their classrooms. The findings indicated that the majority of the secondary school educators were females (58%). Respondents aged 40-49 years accounted for 39.4% of the total response.

Jones (2004) argued that age does not always seem to be a significant variable in the use of computers. However, some studies have shown that young pre-service educators seem to have more positive attitudes towards computers and computer applications (Becta, 2004).

The findings indicate that large proportions (59.6%) of educators have Bachelor's degrees, while 29.2% of these educators only have teaching diplomas. A concerned finding was that educators aged 50-59 years were the only ones who held Master's degrees.

Additionally, these educators aged 50-59 years had been teaching for 21 years or more (33.3%). Teaching experience was considered to be an important factor to include because the lack of it tends to hamper the educators' confidence and competencies.

There seem to be contradictory arguments in the literature concerning the years of educator teaching experience and the extent of computer utilisation by secondary school educators. The majority of secondary school educators (29.9%) had been using computers for one to three years. Surprisingly, (n=41) educators aged 40-49 years had been using computers for eleven years and more, while some (n=62) educators had been using computers for less than one year.

The computer utilisation statistic could be interpreted by using Rogers' innovation theory. He categorised computer adopters into five categories, using the bell-shaped curve (see Figure 2.7). The categories range from people who are eager to use innovations and are normally first to adopt a new idea, to those who resist innovations until they are convinced that the innovation is working successfully.

The results from these statistics do not agree with Rogers' adopter category percentages. Rogers (2003) argued that early adopters (13.5%) serve as change agents and are the first to adopt an innovation, thereby influencing the laggards (16%). This study found that educators (29.9%) were using computers for one to three years and the influence to use computers remained low. However, it could be argued that educators need time to adopt an innovation, and to develop technological skills (Howie *et al*., 2005).

Evidence from the findings (see Table 6.6) indicates that those educators who have been using computers for one to six years (n=448) are fairly experienced, 55.1% of these individuals being able to use computers as a teaching tool in their classrooms.

The literature on the use of computers in schools regarding this variable is ambiguous. Teaching experience appears not to offer any conclusive evidence as a significant factor in its contribution to the use of computers in schools.

According to Reynolds (1992), the literature on effective teaching has shown that experience does not always imply expertise. A study by Hadley and Sheingold (1993) reported that teaching experience was not an influential variable in either younger teachers with fewer years' teaching experience or older teachers with many years' teaching experience. However, they found that computer experience was common to most educators who had included computers in their teaching practices.

This study found that educators who were experienced computer users had made significant progress in the use of computers in their teaching. In some schools, principals were grateful because some of their educators with computer experience tended to have a propensity to become more of an advisor and leader in computer-related issues.

The following section will discuss the multiple-regression analysis of the independent variables that was performed on the dependent variable. Significant predictors of the independent variables to the dependent variable – in the order of their contribution - will now be discussed.

8.4 Multiple regressions on the dependent variable

A stepwise multiple-regression technique was used to analyse the data. The results indicated that three (see Table 5.22) of the six independent variables predicted the highest score on the dependent variable, namely: computer utilisation for teaching purposes. In this study, it was found that the highest predictor was educator pedagogy (R^2=0.227, p<0.01). The second highest was educator theories and beliefs (R^2=0.079, p<0.01); while the third highest was access to computers (R^2=0.023, p<0.01).

The following predictors – training, support and attitudes - did not come out as significant predictors in the use of computers for teaching purposes. In a statistical sense, they did not feature. However, in the qualitative analysis this was a major concern for the principals.

In the quantitative analyses, only partial support was found for the three non-significant predictors, but in the qualitative analysis, more substantial support was found for these predictors.

It is not good science simply to ignore numbers that are statistically insignificant, because in the qualitative interviews they were found to be important in the successful use of computers. Hence, the non-predictors will also be discussed.

The following section will discuss the results of the research questions, as stated in Chapter 1.

8.5 Discussion on research question one

Do educators' **theories and beliefs** have any impact on computer usage?

Research (see 3.15.1) has indicated that educators' theories and beliefs have an impact on how educators use computers in their instruction (Fullan, 1991; Sugar *et al*., 2004).

Twenty-two items in the questionnaire requested educators to respond to their theories and beliefs about computer utilisation. According to the results of the multiple regressions analysis, educators' theories and beliefs constituted the second highest predictor for computer utilisation in instructional purposes (see 6.17-6.18).

In this study, contrary to the literature review, educators were adamant that they had no fear when using computers (see 4.3.5), or if they were struggling to use them during their lessons. Furthermore, this study has indicated that educators (43%) who were strong in their beliefs stated that they would not become dependent on computers and lose some of their pedagogical skills. Educators (59.6%) responded that they had made steady progress in trying to adopt new computer technologies, which could be used during their lesson delivery in the classroom (see 6.11).

This finding is contrary to the Becta (2004), study, where educators who believe that they are not well skilled in using computers feel nervous about using them in a class of learners, some of whom perhaps know more than they do.

Another contradictory finding in the literature suggests that in the teaching profession, there is an inborn resistance to change (Balanskat *et al.,* 2006); which can be seen as another obstacle to some educators' use of computer technologies.

The findings of this study clearly indicate that since the Balanskat study was conducted, educators have made significant progress in altering their theories and beliefs (see 6.11) about the use of computers. Rogers (2003) argued that people hold to their beliefs during the introduction of any innovations. Therefore, it should be acknowledged that educational change is a slow process; and some educators require more time to gain experience with computers.

It is worth noting that most of the educators (81.5%) irrespective of the geographic location of the school and its resources, believed that computers are a teaching aid which could improve the way learners learn (see Table 6.21). This finding supports McCormick and Scrimshaw's (2001) study, who suggested that it is known for educators to regard the use of computers as an efficiency aid.

It is evident from the findings that educator change is a complex process and it involves more than merely changing their theories and beliefs. Educators have feelings, attitudes, concerns, and career histories, which could all influence their commitment to change. Most of the principals stated that the educators in their schools are indeed attempting to use computers in their lessons (see 7.3.5).

8.5.1 Age/Expertise and educator theories and beliefs

The study examined the differences between age groups in terms of educator theories and beliefs (see Tables 6.41 and 6.42). Significant differences were found between educators aged 50 and above when compared with younger educators (aged 40-49) [$p<0.05$].

These differences may develop from the older educators' teaching experience, changes in the trends in education and the educators' inherent theories and beliefs regarding subject matter.

In addition, comparisons were investigated between computer expertise and educator theories and beliefs.

Significant differences were found between the beginners in computer usage and more advanced users (see 6.18.3). It could be argued that the more teaching and computer experience the educator has, the stronger the educators' theories and beliefs become regarding the use of computers.

Therefore, the study suggests that educators' age and computer expertise, in conjunction with educator theories and beliefs, have important roles to play in how computers are utilised in the classrooms.

Given the fact that the majority of the theories and beliefs variables were significantly correlated, (see Tables 6.22 to 6.30) there is sufficient evidence for the support of Hypothesis One which stated that there is a significant correlation between computer utilisation for teaching purposes by secondary school educators in the Western Cape central metropole and educators' theories and beliefs.

Next, follows a discussion on the second research question.

8.6 Discussion on research question two

Do secondary school educators have the necessary **access** to computers?

Mumtaz (2000) strongly believes that access to computers in schools is essential in determining the frequency of use by educators. The findings in this study suggest that this is not necessarily the case, but that schools offering low access to computers do not usually have the required computer equipment (see 6.12).

The questionnaire asked the educators six questions regarding the frequency of access to computer equipment in order to conduct their work. Just over half of them responded (50.1%) that they had never had any access to scanners, whiteboards and printers (see Tables 6.12 and 6.13). Therefore, it seems that these schools were either lacking in computer resources or that these may have been broken, and waiting to be repaired.

The researcher had the opportunity to visit most of the schools in which the research was conducted and observed that there was a roster in place, indicating the various times the equipment could be accessed. However, it was noted that that the amount of equipment was adequate, but inappropriately organised in the school.

For example, an educator using a computer in a classroom to conduct a lesson had a printer installed, which was not utilised, but could have been installed in a classroom where printing was essential. This suggests that equipment should be organised in such a way as to ensure maximum access for all educators. Although frequency of access to computers turned out to be the third highest predictor to computer utilisation, as many as 60.1% of the respondents indicated that they “very often” had access to a computer at home (see Tables 6.12 and 6.13).

This finding supports Rogers’ (2003, p.16) theory of trialability, “in which an innovation may be experimented with on a limited basis”. Educators who have access to computers at home can design and experiment with new educational material. Another finding from this study indicated that only 30.9% of the educators had access to computers via a computer laboratory at school.

The interviews with the principals indicated that educators have first option in using the computers before the learners have any access to them. Upon further investigation, educators complained that when they wanted to work on the computer, it was frequently broken or too slow, and that they had limited time to complete their tasks (see 7.3.4 to 7.3.6).

In addition, the questionnaire asked the educators seven questions regarding the limitation of access to computers. Survey results indicated that the factors which limited the educators’ access to computers were important and needed attention, in order for educators to be able to use computers in their instruction. Educators were dissatisfied because they “often” or “very often” had limited access to classrooms, (50.5%) in which computers could be used (see Table 6.13).

Computer resources in many schools in the Western Cape central metropole were extremely scarce, as most of the schools were located in low-income areas, where school fees were not paid. Hence, the low budget allocated to computer resources. Many educators (19.8%) stated that there were insufficient computers at school to complete their work - resulting in much frustration (see Table 6.13). When they required access to the computers, they were either being utilised by the school secretary, or if they went to the labs, the learners were busy conducting research (see 7.3.4). The researcher observed that in many schools there was an absence of computers in the staff lounges. However, in well-resourced schools this was not the case.

Mumtaz (2000) and Martin and others (2004) believe that evidence of good practice in the use of computers by educators can always be found in schools that have high quality computer resources. Furthermore, Mumtaz (2000) asserts that a lack of computers and software can limit what educators may achieve in the classroom requiring the use of computers. This study found that the educators' access to computers is multi-faceted; and to understand the problem better, it was broken down into sub-dimensions (see 3.15.2.1 and Figure: 3.5).

Failure of educators to obtain access to computers could be due to many factors. These will now be discussed.

8.6.1 Access - lack **and insufficiency** of computer hardware

Evidence on the assimilation of technology (see Chapter 3 and 4) indicates that frequent problems mentioned by educators, which can limit their access to computers, are the inadequate number of computers available to them (see 3.15.2.1).

This study corroborates these findings, where educators (40.7%) confirmed that they had limited access to computers (see Table 6.13). An interesting finding from this study indicates that educators who are more advanced or are more frequent users of computer technology were the first to complain about the lack of computers (see 3.15.2).

Even in the Khanya project, where computer laboratories were installed in schools, educators continued to mention the lack of computers (see 3.15.2.1). This suggests that there could be a problem with the computer-to-educator and computer-to-learner ratios.

Another problem was that the computers (51%) were considered to be outdated, slow and ineffectual for teaching purposes (see Table 6.13). It could be argued that if educators have sufficient access to computers to improve the learning process, then computers must be easily accessible and be of high specification, as well. Although most of the schools have an internet connection to gain access to educational sites and to collaborate with other colleagues, educators (56.4%) responded that internet access at their school was not easily accessible (see Table 6.13).

The majority of educators (66.9%) responded that the schools' network was unreliable and frequently inaccessible, which added to their burden of administrative and student-monitoring tasks (see Table 6.13).

8.6.2 Access – **difficulty** of computer software

This study found that all the programs installed on the computers by the Khanya project were fully licensed; and educators (53.2%) were "never" inconvenienced or barred from gaining access to educational programs (see Table 6.13). However, it was also found while analysing the comments of some educators, that there were many software programs installed on the schools' computers, which educators found difficult to use. This process resulted in a few educators aborting the process, providing them with a good reason for not wanting to use the computer.

8.6.3 Educator access – use of home computers and technical problems

When discussing access to computers, it is important to consider the access to computers that educators need in order to conduct their lessons. Moreover, it is equally important for educators to have their personal access to computers in order for them to prepare their lessons without any disturbance (see 3.15.2).

In this study, most of the access to computers was done from the educators' homes. The findings in this study (see Table 6.12) have indicated that (74.1%) educators never had access to the computers in their school laboratory (6.3%), library (38.2%) or media centre (29.6%). This statistic suggests that educators have limited access to computers within their working environment, and this could be another barrier preventing them from using computers.

Another concern educator's face regarding access to computers is when the computer breaks down or stalls during a lesson (see 3.15.4.5). This action inadvertently has a negative impact on the educators' ongoing use of computers. A common concern in this study was that when computers in schools became inoperable, the fault had to be logged at the education department. In most cases, the fault took longer than normal to repair, and this caused educators to lose interest in the use of computers at school. Many schools could not afford their own computer technicians, and had to depend on the department for technical support (see 3.15.4.5).

8.6.4 Access and age

The study examined the differences among age groups in terms of access to computers. Significant differences were found between educators aged 40-49 years and educators aged 50 and above (see Table 6.33). The study suggests that age may be a factor that could hinder the educators' access to computers, meaning older educators are less likely to engage with computers.

This assumption is supported by an European Commission report (cited in Becta, 2004) that as educators become older, their use of computers decreases. However, the report concludes that the importance of this factor is declining.

Given the fact that the majority of the access variables were significantly correlated, (see Tables 6.22 to 6.30) there is sufficient evidence for the support of Hypothesis Two which stated that there is a significant correlation between computer utilisation for teaching purposes by secondary school educators in the Western Cape central metropole and educators' access to computers.

The next section discusses the findings on the third research question.

8.7 Discussion on research question three

What is the impact of educators' **attitudes** on using computers for teaching purposes?

Educators must be seen as important change agents in schools, and their attitude towards computers plays a significant role in the successful use of computer technology in schools (see 3.15.3). A report by Becta (2004) revealed that there was a tendency among educators worldwide to feel threatened by the presence of computers in their schools.

In this study, educator attitude was not a statistically significant predictor of the use of computers for teaching purposes. There was insufficient evidence to support the multiple-regression correlation between the two variables (see Tables 6.25; 6.27; 6.28; 6.30 and 6.31). However, partial support was found, and the results of the survey will now be discussed.

In addition, during the interviews the principals highlighted the fact that educators' attitudes do have an impact on their usage of computers (see 7.3.4 and 7.4).

It should also be noted that two factors, namely: positive and negative attitudes towards computers, emanated from the exploratory factor analysis (see 5.15). Educators responded to seventeen items on the questionnaire, regarding their attitudes towards computers. Seven items were treated as positive attitudes and 10 items as negative attitudes. The findings suggest a positive (70.3%) attitude towards computers (see Table 6.14). In general, "computers are a fast means of getting information" (57.1%); and, "I think working with computers would be stimulating" (58.7%) were some of the most frequently agreed upon items (see Table 6.14).

During the study of the literature, it was found that educators gain positive attitudes towards computers through government interventions and training programs (Balanskat *et al.,* 2006). In order to enhance educators' attitudes towards computers, negotiations are currently in place to provide each educator with a laptop.

This notion should be carefully addressed because exposure to computers does not necessarily generate any interest, unless the educator has a positive attitude towards computers.

The literature pertaining to attitudes is complex, and it should be treated with caution. Evidence in the literature indicates that great progress has been made in raising educators' positive attitude towards computers (see 3.9; 3.15.3 and 3.15.5). A study by Pamuk and Peker (2009) concluded that for educators who could not afford their own computers, this adversely affected their attitude levels. Furthermore, they stated that improving the quality and accessibility of computer resources would assist educators to develop increased levels of computer confidence. Educators need to reflect and examine their concerns on the use of computers. Any issues or fears should be discussed with their peers.

During the principal interviews, it was found that although many educators were working in challenging times, they displayed positive attitudes about continuing to use computers in their own way. They perceived computers to be useful educational tools, which – it was hoped – would improve their pedagogical skills (see 7.3.2).

Despite being excessively exposed to administrative duties, which required repetitive computer use, a minority of educators (17.3%) expressed negative attitudes about the training they had received; and they maintained that it had had no impact on their teaching practices (see Table 6.16).

8.7.1 Educator attitude and age

This study examined the differences between the different age groups in terms of the educators' attitudes towards computers. Significant differences were found between educators aged 50 and above, when compared with educators aged 40-49 years (see Table 6.34). This finding suggests that some educators in the 50-year (and above) age group had negative attitudes towards computers (mean difference = -1.30172*). This could be attributed to the period of their pre-service training, the number of years experience in teaching - using the traditional chalk and board - and their experiences with computers.

Older educators are often wary of new ideas and technologies with no evidence of success. Research studies have found that negative educator attitudes may be caused by computer anxiety (Becta, 2004).

Some educators can develop negative attitudes towards computers because they do not keep themselves updated on the latest trends in computer technology (see 3.15.3). As the problem of retaining educators in the teaching profession increases in South Africa, efforts should be increased to prepare future educators to integrate computers in their instruction. Therefore, it will be necessary for pre-service educator programs to instil positive attitudes towards computer technology. Educators' attitudes were not found to be statistically significant contributors to the use of computers in schools (see Table 6.25 and Tables 6.27-6.31). Notwithstanding, the qualitative reviews by principals found some support for this viewpoint. Principals believed that they could change the attitudes of educators, by means of increased support and additional funding for more computers, thereby increasing access (see 7.3.5 and 7.5).

Given the fact that the majority of the attitude variables were not significantly correlated, there is insufficient evidence for the support of Hypothesis Three which stated that there is a significant correlation between computer utilisation for teaching purposes by secondary school educators in the Western Cape central metropole and educators' attitude towards computers as an instructional medium.

The next section will discuss the findings of the fourth research question.

8.8 Discussion on research question four

What **support** do educators receive to use computers for teaching purposes?

Hargreaves (1994) believes that educators do not ask for support from other colleagues and that much of their work is conducted in isolation. The findings from this study do not provide sufficient evidence to support Hargreaves' findings. The questionnaire asked the educators ten questions regarding their support they received in their utilisation of computers.

Two factors, namely: administration and collegial support, emanated from the exploratory factor analysis. The statement that produced the highest responses (64.4%) was “My colleagues assist me with computer-related issues” (see Table 6.15). This suggests that there is a serious lack of formal support structures in secondary schools and that support is mostly rendered by colleagues despite their own priorities they have to attend to during school hours. Additional strain is placed on such educators when they seek to assist their colleagues who are struggling with computer issues.

Among the various difficulties associated with the use of computers in secondary schools, this study found that limited access to computers, the different types of software, which influence the support offered by the WCED, affect the quality of support provided to these educators (see 6.14 and 7.3.6).

Attention is drawn to the needs of secondary school educators, as most of them believe they need more technical support and training. In addition, the educators believe that they desperately require support to develop their technical skills and knowledge, because computer glitches during lessons have become more frequent. Similar sentiments were expressed by the principals of many schools (see 6.14 and 7.3.6).

This is further supported by educators (46.5%) who “strongly disagree” and “disagree” that the administration provided an onsite computer technician to assist them with their computer issues (see Table 6.15). Interviews with principals of some of the schools revealed that limited or no supportive personnel were found in government-funded schools due to budget constraints.

Information gleaned from the comments of the principals’ questionnaires, it was found that schools situated in more affluent areas (e.g. formerly model C schools) - the situation was slightly better, because many of these schools had additional funds to employ a full-time computer technician.

There seems to be a need for most educators to have more time to participate in planning their lessons with computers, to have fewer pupils in their classes, more in-house training and support on educational computer programs, as well as additional technical support. This may have an impact on the educators' motivation to use computers in their instruction, more often: thereby overcoming their own limitations.

At a higher level, principals of these schools need to support their educators by providing more time for them to plan for the use of computers in their instruction. In addition, the principal must be able to create opportunities for the educators to share their ideas with other colleagues. Some of these opportunities should include visits to neighbouring schools to observe how other educators are using computers in their instruction. This study found that in many schools the person who was providing computer support was also an educator (see 7.3.6).

Therefore, provision of more time (i.e. reduction of teaching time in class) should be extended to computer-support staff so that they can support educators who are struggling with using computers. This is not happening at present and the dual function of computer-support staff member and educator is ineffective because of the additional workloads.

The problem is however the current shortage of resources and large classes due to insufficient government funding and the lack of adequate school fees. Perhaps in the near future, the South African Department of Education will have to budget for computer support staff in all schools.

8.8.1 Educator support and age

This study has examined the differences among age groups in terms of the support educators received. Significant differences in administration support (mean difference=2.01097*) were found between educators aged 50 and above when compared with educators aged 40-49 years (see Table 6.35). This finding suggests that educators aged 50 and above are receiving more administration support than their younger colleagues.

The research finding could probably be attributed as explained earlier, to older educators that might not have had the same exposure to computers during their teaching career; and their beliefs and attitudes towards computers might be different from those of the younger educators. Hence, some of the older educators might require more support. Alternatively, there could be a lack of collegiality among secondary teachers, which could prevent older educators from receiving support from the younger group.

It may be assumed that younger educators would be more advanced in computer technology than their older colleagues would. Interviews with the principals indicated that technical faults with computer equipment are more likely to lead to lower levels of computer use in older educators, while the lack of administration support causes additional frustration for these educators (see 7.3.5 and 7.3.6).

In addition, significant differences in collegial support (mean difference=0.79065*) were found between educators aged 50 and above when compared with educators aged 20-39 years (see Table 6.43). Because this finding is in the positive, suggests that educators aged 50 and above, are familiar with the use of computers in schools. Furthermore, these older educators may act as mentors to the younger educators who might have only recently joined the teaching profession, in order to be able to make use of computers. The findings of educator support in this study are in agreement with previous research findings of educators who considered that most forms of computer support are crucial factors that motivate them to use computers in their instruction (Fullan, 2001; Sherry *et al*., 2000; Smarkola, 2008; Hadley and Sheingold, 1993).

It also supports Rogers' (2003, p.318) theory that people are dependent on each other; and peers in the same environment can either positively or negatively influence any decision to adopt an innovation.

Given the fact that the ten support variables were not significantly correlated (see Tables 6.27 to 6.31), there is insufficient evidence to support Hypothesis Four which stated that there is a significant correlation between computer utilisation for teaching purposes by secondary school educators in the Western Cape central metropole and educators' support for using computers in classes.

The next section discusses the findings on the fifth research question.

8.9 Discussion on research question five

Does **training** make a difference in the level of computer use by educators?

As alluded to earlier, this study found that educator pedagogy was the highest predictor of computer utilisation in secondary schools (see paragraph 8.4). However, throughout the literature review (see Chapter 3), emphasis was put on the importance, value and consequences of computer training for educators. Many studies argued that educators were either disappointed by the training they had received, or that the training they had received did not add any value to their computer skills (Blankenship, 1998; Fullan, 2001; Selwyn, 2000; Galanouli *et al*., 2004; Carnoy, 2004; Howie *et al*., 2005).

Based on the literature review (see 3.15.5), twenty-two items addressed the variable on training, but lamentably this study found that it did not contribute to the use of computers in the classrooms, although 90.9% of educators had received computer training (see Table 5.9).

However, principals strongly believe that training is an ongoing process, because technology is evolving at a fast pace and educators need to keep themselves updated on the latest technology (see 7.3.7).

Principals are also aware that many educators have insufficient time to allocate to training, and they tend to revert to self-study or self-training. Many principals stated that there is a lack of follow-up on the utilisation of the newly acquired skills after the training has been done.

The danger of inappropriate training styles can lead to low levels of computer use by educators and there must be an element of skill inculcated in computer training (Preston *et al*., 2000). Although the WCED had many computer training programs in place for educators, it was found that either the instructors were incapable of delivering adequate training, or assumptions were made that the educators knew all the basics of computers (see 7.4).

During the interviews with the principals of some schools, principals maintained that the training was too advanced; consequently, educators could not navigate their way between the programs. Educators are looking for good easy-to-use programs of high quality that will encourage them to use computers in their instruction (see 3.12; 3.15.1 and 3.15.2.3).

Clark (2000) firmly believes that training programs should not only improve educator skills in the use of computers, but they should also assist educators in changing their attitudes about the use of computers in their instruction.

The questionnaire asked the educators 22 questions regarding their training in computers. A total of 74 respondents indicated that they had not received any training while 738 did. Educators that did not receive training (n=74) indicated that they were engaged in a self-training process (see Table 6.9). However, there could be dangers in the self-learning process. When training is considered inadequate, inappropriate or of inferior quality, then educators will not be well prepared to use computers in their instruction.

The question of training is complex and many factors are considered important in ensuring that the training is effective. Some of the reasons cited in the 'comments' section of the educator questionnaire for self-training were, insufficient time, no transport to training venues and learning by discovery. Therefore, Kirkwood and others (2000) warn that expecting educators to train during their own time and at their own pace causes a slow uptake in the assimilation of any training they might have received.

Educators (56.4%) in this study responded that they regarded training that covered the basics in computer technology as being of "very high value" or having "high value" (see Table 6.17). This finding suggests that not all educators are on the same level of computer expertise and have a different number of years' experience in teaching with computers (see 4.3.4).

In addition this study enquired about the various levels of computer usage which educators were at. The levels of computer usage were coded into three groups namely: beginner, average and advanced and was labelled 'computer expertise'.

Differences in the level of computer expertise and training (see Table 6.54) have revealed that the most significant differences were between advanced computer users and beginners (mean difference=5.36537*). This is a surprising finding, the reason being that when new educators (regardless of their age) are brought into the main stream of teaching, they should already be confident enough to use computers in their instruction. Sadly, this is not always the situation as expressed by Molepe (2006).

Despite the manifold advantages that training in computers provides, only 46.7% of educators in this study implemented their training into practice (see Table 6.16). It may be argued that educator- training institutions in poorly funded provinces in South Africa are poorly equipped to provide effective training in using computers. Nevertheless, alternate plans should be devised.

8.9.1 Educator training and age

This study has examined the differences between age groups in terms of the training that educators have received. Significant differences (mean difference=2.27718*) were found between educators aged 40-49 years when compared with educators aged 50 and above (see Table 6.36).

Based on the results of this study, the consequences of the training factor seem to concentrate mainly on the skills aspect of training. This is corroborated with the interviews conducted with the principals of some secondary schools.

Although these principals expressed the need for computer technical training and pedagogical training, they strongly believed that there is an important need to train educators in specific computer skills (see 7.3.7). Congruent with other research, principals believe that some of their educators suffer from computer anxiety that often hinders the educators' effective use of computers in the classroom (also compare Mueller *et al*., 2008).

Although computer anxiety was not part of this study, many principals believe that a way of overcoming this anxiety is to enlighten the pre-service educator with computer courses early in the training program (see 4.3.5).

Principals stated that some of their older educators refused to use computers during school hours; and that they did not find any need for them. Furthermore, the principals argued that older educators have many years of teaching experience and are set in their teaching style, irrespective of the amount of computer training provided to them. Continuing the discussion, some principals, as per their comments on the questionnaire, maintained that “many educators are of advanced age and might not have had any computer training when in college”. Therefore, a few principals suggested that the current need is for more computer skills-training to allow advanced educators to make use of computers in their work at school (see 7.5).

The erudite scholars, Snoeyink and Ertmer (2000), provided a solution, stating that training should be organised according to the educators’ experience and level of expertise in using computers. Conducting training in this fashion allows various skills in training to be delivered according to the needs of the educator which, according to this study, may be related to their age.

Principals were also concerned that pre-service educators were receiving very basic computer exposure in training facilities and by the time they had completed their teacher training, it would be outdated (see 3.15.5).

Vannatta and Beyerbach (2000) strongly believe that superficial courses in computer basics are inappropriate for pre-service educators and do not prepare them adequately to use computer technology in their classrooms.

Given the fact that 22 of the training variables were not significantly correlated, there is insufficient evidence for the support of Hypothesis Five which stated that there is a significant correlation between computer utilisation for teaching purposes by secondary school educators in the Western Cape central metropole and training for educators to use computers in their classes.

The next section will discuss the findings on the sixth research question.

8.10 Discussion on research question six

Which educator **pedagogical** factors determine the use or non-use of computers for teaching purposes?

The introduction of Outcomes-Based Education (OBE) has changed the way educators teach and students learn in South Africa. In the past, the focus was directed on teaching and holding educators responsible for what they teach. Currently, educators are accountable for what and how students learn. It is within this brief background that educator pedagogy and the use of computers in education are discussed.

The questionnaire asked the educators 20 questions regarding educator pedagogy. The multiple-regression analysis found that pedagogy was the highest predictor of computer utilisation. Three factors, namely: importance, confidence and productivity emanated from the exploratory-factor analysis (see Table 5.40).

Contrary to the review of the literature, this study found that the educator pedagogy variable produced the highest prediction to the utilisation of computers in classrooms (see Table 6.22). Pedagogical ideas are developed from theories on how people learn, and the introduction of OBE in South African schools may have had an influence on the methods educators use to teach.

Vygotsky (cited in Barlett and Burton, 2009), believed that in order to take the learner forward, new ideas and concepts must be used during the dissemination of knowledge.

A large percentage of educators (78.1%) regarded the use of computers to search for new teaching material and practices as being “very important” and “extremely important”. This implies that educators are committed to changing the art of teaching, thus providing better dissemination of information to their learners (see Table 6.19).

During some of the principals’ interviews on educator pedagogy, principals reported that the educators in their schools are predominantly using the computers for finding new ideas in their specific subject areas.

Many principals supported this notion and believed that the information which was included in educator teaching materials became outdated to soon. In addition, principals believed that educators enjoyed using computers in their instruction, because previously stored information was easily retrievable and accurate (see 7.3.5).

On how educators use computers to teach in their classrooms, a minority of 17.6% indicated that it was not important to use computers to enhance the learners' communication skills (see Table 6.19). This implies that most of the educators were of the view that the use of computers is an important teaching aid when imparting knowledge to the learner. The latter finding supports the statement that educators (81.5%) "agreed" and "strongly agreed" that the use of computers during their lessons stimulates the creativity of the learners (see Table 6.21).

Educators (85.3%) indicated that they used computers to prepare their lessons, which in turn increased the educators' productivity in the classroom (see Table 6.21). This finding means that well-prepared lessons enable educators to demonstrate their capabilities in using computers effectively in classrooms and not to be embarrassed by learners being more knowledgeable than they (the educators) were in certain computer skills. It is therefore imperative for educators to use the computer carefully when conducting research for lesson preparations.

During the assessment of the literature, it was evident that different types of computer usage require the educator to have a broad understanding of various computer skills. Moreover, the literature stated that educators should be able to harness these skills in order to extend the educators' pedagogical knowledge, so that they can use computers effectively in all their teachings (see Chapter 3).

The findings of this study support the literature in that educators (92.2%) strongly supported the fact that "computers can be useful instructional aides in all subject areas" (see Table 6.21). Furthermore, principals reported that educators used computers because they provide a huge selection of learning material, and in addition can act as a tutor in the classroom (see 7.3.2 and 7.3.5).

When it comes to slow learners, educators can use the computer for remedial work, thereby allowing these learners to work at their own pace. The findings indicate that despite educators (36.7%) seldom having access to resources at school, they do have a good understanding of the particular resources, which are available to them - for example the internet (see Table 6.20).

Conversely, there are some educators (42.5%) who are lacking a wide spread of knowledge regarding the present bouquet of computer programs now being offered in education (see Table 6.20). If the educator has a lack of computer knowledge, inadvertently this will have an impact on the students, because students will suffer the loss of learning opportunities, which computer technology could have provided.

Another important pedagogical factor considered in this study was how educators were using computers to reflect on their teaching practices. The findings indicated that educators (70.3%) found it “important” and “very important” to do so periodically (see Table 6.19). An important aspect of educators’ pedagogies is in the planning, preparation and follow-up of lessons. Educators believe that the use of computers produces a significant improvement in the learners’ results if used correctly.

There is a basic misunderstanding by many educators on how to incorporate computers into their teaching program. It is therefore recommended that educators should periodically reflect on their pedagogical practices.

It has been argued in the literature that the educators’ own pedagogical beliefs contribute an important component in determining technology-mediated learning opportunities (Mueller *et al*., 2008). A concerned finding in this study was that some educators (32.6%) were “not very knowledgeable” and “not at all knowledgeable” on how the use of computers could support their pedagogical professional development (see Table 6.20). Accordingly, there seems to be a void in knowledge - even among many of the innovative educators regarding the potential of other computer uses, which could enhance the learners’ progress. Therefore, educators need to evaluate their present knowledge and pedagogies regarding computers and consider some of the following guidelines, as suggested by Becta (2004):

- Knowing how to use computer resources, which will enhance the learning of students in the particular subject;
- Knowing how to prepare and plan lessons where computers are used, which will challenge the students' understanding and promote reflection and thinking;
- Knowing how to challenge students engaged in computer-based learning tasks; and
- Knowing how to integrate computers into their pedagogical practices: this would complement their other teaching and learning activities.

It is heartening to note that it is across the three pedagogical factors, namely: importance, confidence and productivity that most of the educators strongly agreed that computers were beneficial to educators, learners and the principals, because they introduced a change in methods in the educators' pedagogy (see Tables 6.19 to 6.21). Furthermore, principals profess that using computers in teaching breaks the boredom in the classroom (see 7.6).

8.10.1 Educator pedagogy and age

This study has examined the differences among the different age groups in terms of educator pedagogy. Significant differences (mean difference=4.52247*) were found between educators aged 20-39 years, when compared with educators aged 50 and above (see Table 6.37). This implies that the younger educators have different approaches to educator pedagogical beliefs when compared with the older educators due to their more recent training and development in educational pedagogy.

Educator pedagogical experience assists the educator when relating to new situations and to investigating new approaches to learning. This situation is commonly found in circumstances where newly appointed educators are assigned to teach in areas with which they are unfamiliar (Eteokleous, 2008; Smarkola 2008; Ward and Parr, 2010; Martin *et al*., 2004).

Younger educators in this study were keen to learn new pedagogical techniques and to use the computer in their instruction.

They received most of their assistance from their peers and tended to attach themselves to a supportive environment where older and more experienced educators who had used computers extensively could guide them. The literature seems to suggest that younger educators have more positive attitudes in changing their teaching styles and utilising the advantages of computer technology as well as to become change agents in their schools (see 8.5.1; 8.8.1 and 8.10.1).

Finally, the findings indicated that approaches to educator training should be better related to the notion of information sharing and peer learning (see 6.15). In addition, educators should be able to improve their computer skills and gain more pedagogical knowledge. Accordingly, if educators experiment with computers every day, it should increase their pedagogical competence (see 6.16).

Given the fact that the majority of the pedagogy variables were significantly correlated, there is sufficient evidence for the support of Hypothesis Six which stated that there is a significant correlation between computer utilisation for teaching purposes by secondary school educators in the Western Cape central metropole and educators' pedagogy.

The next section will discuss the findings of the seventh research question.

8.11 Discussion on research question seven

How are educators using computers to teach? What do they perceive as the barriers to computer use?

Throughout this study, the emphasis has been on how to determine and to investigate ways of raising the level of computer usage in the classroom. One could argue that there is no sense in raising the level of computer use if it yields no value. Therefore, it is useful to establish how knowledgeable educators are in using computers in their classrooms.

Eighteen questions were asked on the educators' level of proficiency when using the computer various tasks. Functional tasks, such as swapping between applications (73.8%), copying, renaming and deleting files (61.6%) appear to be used quite easily by the educators (see Table 6.10).

This implies that educators do have the functionality skills for conducting basic computer tasks and thus supports Rogers' (2003) theory of innovation attributes of relative advantage, compatibility and complexity. When educators have this skill, the perceived complexity of using computers decreases (see Table 6.17) and will improve their rates of adoption (56, 4% agreed in the training of basic computer skills).

Educators reported that they had no knowledge when it came to procedural tasks, such as real-time discussions (26.4%), which are used to collaborate with other educators regarding matters in education. Understanding how to use a data projector (22.9%), using a database in lessons (18.3%), and using graphic software (14.3%) were some of the items of which educators reported they had no knowledge (see Table 6.10).

This implies that educators have low levels of computer use when it comes to mainstream applications. A lack of this skill could hamper the educators' from using the computer to assist them in expressing difficult concepts during their lessons. Limited knowledge - or no knowledge - could be regarded as passive barriers to computer use, because these barriers can be overcome by training, additional support or individual mentorship supplied by computer support personnel and educators with excellent computer knowledge and skills.

During the principal interviews, it was confirmed that time seemed to be a major barrier in the preparation of lessons using the computers. This affected the educators' preparedness to use computers. Furthermore, principals acknowledged that there were attitudinal and pedagogical barriers that could have influenced the use of computers in classrooms (see 7.3.4 and 7.4).

These barriers, as discussed in Chapter Four, are known as second-order barriers. Second-order barriers comprise educational theories and beliefs, skills and pedagogical problems. In addition, these barriers are arguably more powerful in hampering educators when attempting to use computers effectively. These barriers reside in the educators' theories and beliefs and are not visible to others, even to the educators themselves.

Findings from the study indicated that some of the barriers with which educators are confronted are the difficulties experienced in integrating computers into their syllabus and gaining access to a computer (50.5%) during school hours (see Table 6.13).

The literature indicated that educator time was another barrier to computer innovation (Pelgrum and Law, 2003). Contrary to Pelgrum and Law, the statement regarding how much time the use of computers required for educators to prepare their lessons appeared to influence the use of computers in this study. Educators (56.2%) either “disagreed” or “strongly disagreed” with the statement that ‘using computers in my teaching makes preparing for lessons time-consuming’ (see Table 6.11). This implies that educators in this study had managed to use their time satisfactorily to utilise computers in their instruction.

Based on the above findings and discussions, there seem to be some barriers that are preventing educators from using computers in their instruction. These can be broadly separated into two groups, namely barriers relating to the educators themselves, and those relating to the school’s infrastructure. Educator barriers are about their training, support and skills in using computers. School barriers were the actual computer access and insufficient resources, such as interactive white-boards, and internet connectivity and old or poorly maintained computers.

Educators stated in their comments that although they had received the basic and pedagogical training in computers they were still unable to utilise that training in practical terms, because they were held back by a range of school barriers (see 3.9; 3.12 and 3.15.4.3).

Conversely, during the interviews, principals from some of the schools stated that although a few educators had excellent computer skills in terms of the educators’ personal use, they were incapable of transferring these skills to the use of computers in the classroom.

8.12 Conclusion

During the recent past there has been an influx of educational policies and projects with positive intentions to improve the quality of education in South African schools. Furthermore, it has been observed that there is an inclination within the education department to create new models of educational change, instead of drawing upon what has been developed in the past.

With the rate at which educational costs continue to rise in schools, South African learners are facing changing paradigms in the way in which education is delivered. Educators continue to teach amid conflicting expectations and pressures from learners, parents, principals and school-governing bodies.

Secondary school educators in the Western Cape central metropole appear to be using computers for student monitoring and other administrative tasks. However, the study indicated that while some educators are using computers in their classrooms, many are not. Educators do have the necessary computer skills to perform basic tasks. However, access to computers seems to be problematic.

It should be noted that access to good quality educational software programs is an excellent promoter that motivates the educator to use computers in his/her instruction. It is heartening to note that educators' pedagogy was the highest predictor to computer utilisation, implying that educators in general are changing their approach to teaching.

Secondary school principals in the Western Cape have positive attitudes towards the use of computers in their schools over and above some of the major obstacles they face, such as the lack of resources. Principals are continuously grappling with budgetary constraints. The increased enrolment in secondary schools has increased their burden in purchasing additional computers and in repairing existing equipment.

Non-fee paying schools are even more affected, as they have to raise their own funds to ensure educators have a few computers with which to conduct their administration work. In some of these schools, private institutions have offered their services to donate, install and maintain computer equipment.

In addition, many principals are providing support to motivate and encourage educators to use computers in their instruction. Providing the proper computer support for the educators needs to become an increasingly vital feature of the systemic process of change.

As evidenced in the findings, educators and principals need continuous support from the WCED administration - whenever technological innovations are implemented.

Some principals have stated that it is sometimes impossible for educators to get even close to a computer due to the lack of teaching staff and the lack of computer resources.

Therefore, in order for principals to encourage and motivate their educators to use computers, the department of education must create conducive school environments by ensuring adequate staff in schools, proper training, sufficient computer equipment and technical support for educators. The principals also highlighted the importance for pre-service educator computer training before they are allowed to teach in schools.

In addition, the principals believed that although there were numerous educational training sites, educators found that these were not well structured. Moreover, principals stated that the material may not be presented in a logical layout and software support may not be readily available.

It was found that in many schools, Information, Communication and Technology (ICT) policies were in place, but often it was found that these were not being implemented. Most schools had policies indicating that educators must receive basic computer training. Educators in secondary schools must be supported and shown how the use of computers in their instruction can be of benefit to the whole educational system. This study indicated that merely using computers would not bring about the required changes in secondary schools.

Educators who are trained and are competent computer users will assist in increasing the use of computers for instructional purposes in classrooms. Although the majority of educators had received some form of computer training, many reported that this was either beyond their understanding or not very useful. There might be a danger that educators could use this as an excuse not to incorporate computers in their instruction.

Educators seem to stay with the instructional methods with which they are comfortable and familiar. Finally, proponents of the education system cannot afford to ignore the impact that computers have had on learners and on educators.

Educators are considered to be the backbone of the education system and therefore, the following recommendations are made to enhance the use of computers amongst educators in schools.

8.13 Recommendations

Based on the results of this study, a range of practices has been identified which should be part of all educators' teaching framework if they intend to effectively include the use of computers in their classrooms.

The following recommendations are made:

8.13.1 ICT school policy

The findings in Chapter 7 indicated that there are many schools in the Western Cape central metropole that are aware of the WCED ICT policy, but have no proper implementation plan in place to execute the policy. The findings from this research indicate that there are some schools who have devised their own internal ICT policy, because they felt that the WCED ICT was not conducive to their schools' situation.

An important finding here suggests that a province-wide ICT policy does not necessarily mean that the schools will be able to implement such a policy.

The recommended approach from the findings of this study suggest that there must be an overall ICT policy - as a guideline line only - indicating what the education department intends to achieve. In order to accomplish an improved or enhanced use of computers in schools, this study strongly recommends that each school should have its own ICT policy, based on the school's geographic location, computer resources, practical constraints and finances.

This policy could easily be devised with the assistance of the department of educations' district manager responsible for these schools. Based on the responses of the principals and the recommendations from the findings of this research, there are some issues that need to be considered when developing the individual school's ICT policy, since fresh needs and challenges continually arise. They are:

- The ability to develop a comprehensive educators' computer training program for in-service educators. This program must start with the basics of computers, progressing to advanced levels in the use of computers; and it must specifically be related to the educator's teaching program;
- Ensuring the continuous support, maintenance and financing of all computer resources from the WCED. Therefore, there must be a practical solution to finance the enhanced or improved use of computers in education, and special attention should be provided to schools in disadvantaged areas;
- The ICT policy must be as short as possible to guide its successful implementation; and
- The implementation of the school's ICT policy should be monitored by the school circuit manager and evaluated periodically to ensure that the policy is effective.

8.13.2 Physical resources

As suggested from the findings, educator support and access to computers are regarded as important contributors to the improved use of computers in schools. For ease of explanation, access and support have been combined, and these are now labelled as 'physical resources'. The finding suggests that access to computers outside the school will continue to remain a big issue for some time to come.

In Chapter 3, it was found that when educators have access to computers, they rapidly become confident and significantly, they become more competent in using computers. Chapter 6 presented the findings. These showed that educators complained about the limited access to computers, which affected their use of computers in schools.

This study found that as educators have enjoyed more personal access to computers, this has facilitated the development of their computer skills.

In conjunction with access to computers, it was also found that without the necessary support from their peers and colleagues, they were hampered in their professional development in the use and integration of computers into their teaching schedule. Although the administration support was not as influential as collegial support, educators seemed, in any case, to rely more on their colleagues for assistance.

Recommendations from the empirical findings of this study suggest that the following points should be seriously considered in order to ensure that educators do not become demotivated due to the shortage of physical resources:

- Schools must have in-house support staff for the effective use of computers;
- Personal access to computers may increase the effective use of computers;
- Computer resources must be well integrated. This could be achieved by networking all the computers within the school. By doing this, it would allow the educators to gain access to their work wherever they are within the school; and
- For the effective and increased use of computers in schools, there is an immediate need for the department of education to increase the amount of computers in schools, so that more access to computers is made available to educators and learners.

8.13.3 Computer training for principals and educators

As alluded to earlier, the quantitative analysis found little support for the training variable. However, the qualitative analysis found strong support for it. In Chapter 3, it was confirmed that training is extremely important, and this study suggests that computer training should not necessarily take the educators away from their schools. From the responses, it seems that the best training is when it is provided "on the job", as the need arises.

Principals agree that their educators are the most crucial resources in their schools. Consequently, educators should be increasingly involved in the use of computers in their classrooms. Therefore, this study strongly recommends that:

- Educators need confidence in using computer resources. This can only be achieved through continuous training and frequent practice;
- Compulsory computer use in educator university training programs may increase the pre-service educators' expertise in computer use, leading to increased usage in schools;
- Principals must be trained in computer management of resources and must have some form of computer literacy to enhance the use of computers in their schools;
- Principals need to be pro-active and invite computer experts from large businesses (as part of their social responsibility plan) to re-train educators in their schools; and
- All educator training facilities and universities must use computers to train the new educators - thereby increasing the competency and computer skills of the new educator. Furthermore, pre-service educators must be assessed on their computer skills in presenting their lessons. They need to show themselves to be competent in the use of computers before being allowed to teach in schools.

8.13.4 Educators' attitude and computers in education

Using the attitude theory of Fishbein and Ajzen (1975), this study has been able to deduce the fact that educators' level of attitude determines the degree to which they intend to use computers in their instruction. Therefore, the educators' attitude towards the use of computers is a good indicator of their use of computers. Unfortunately, the quantitative analysis procedure found the least support for the attitude variable in the use of computers in schools.

However, it is heartening to note that most principals (the qualitative results) in this study strongly believed that if the attitude of the educator changed to be one of a more positive nature, then the principals would certainly see an increased usage of computers in their schools.

The principals attributed the negative attitudes towards computers to factors such as educator-computer anxiety, confidence and training. Therefore, this study suggests that when attempting to change the negative attitudes of educators to a more positive attitude, the following taken into consideration:

- When educators have ownership of their own computers it tends to increase their self-efficacy and attitude towards computers;
- Acquaint educators with computer technology early in their training programs. Such training should be specifically designed for them; and
- There need to be continuous on-the-job training programs with technical support from the WCED.

8.13.5 Educators' theories and beliefs

Based on the quantitative analysis, educators' theories and beliefs provided the second highest prediction to the enhanced/improved use of computers in secondary schools. In Chapter 3, it was found that there were instances where educators had no intention of changing their teaching theories and beliefs without first seeing the benefits.

In Chapter 4, Rogers (2003) argued that people will only adopt an innovation if they think it will yield some relative advantage to the idea that it is intended to supersede. In this study, the empirical evidence indicated that there are clear indications that educators can see the benefits of using computers as an additional instructional tool – hence, they are more likely to change their beliefs and adopt the technology. Therefore, in order to inspire other educators with their belief that the use of computers in their teaching instruction enhances the learning process for both educators and learners, the following recommendations are made, and should be implemented with extreme caution:

- Educators' theories and beliefs should gradually be changed by submitting to greater pressure from the school principal requesting the increased use of computers in educators' instruction. Moreover, this process must work in conjunction with improved computer access, support and training;
- Self-efficacy refers to educators' perceptions and capabilities to apply computers in their instruction. Educators' self-efficacy beliefs seem to have a positive influence on computer use. Therefore, this belief must be conveyed to educators who have negative attitudes towards the use of computers.
- Education teaching programs must provide pre-service educators with a conducive and non-threatening learning environment so that they may experience success in using computers in their instruction.

8.13.6 Educators' pedagogy

Finally, the findings from this study have clearly shown that educators' pedagogy provides the highest prediction indicator of the improved or enhanced use of computers in secondary schools. The advent of OBE in the present South African educational curriculum has forced educators to make learning more meaningful - instead of just imparting knowledge.

Certain innovative practices - such as the use of computers - have provided some solutions to the teaching profession. However, the use of computers has placed an extra burden on some educators, since not all of them are equally computer literate.

In this study, it was found that computers assist many educators to change their practices in the classrooms.

Furthermore, it was found that educators with student-centred pedagogical approaches (see Chapter 6, Table 6.7) were more successful in using computers in their lessons. Therefore, this study strongly suggests that in order to harness the educator pedagogies so that they can be used to increase the use of computers in schools, the following recommendations should be taken into consideration:

- Educators need to understand that computer technology is continually evolving, and that they need to change the manner in which the subject is presented to the learners;
- Educators need to know how to prepare and plan lessons where computers are used, so that the lessons challenge the learners' understanding and stimulate reflection and thinking; and
- In order to improve the innovation of classroom activities, the educators' philosophy of teaching approach should be continuously reviewed.

From the empirical findings of this study, a model or framework (see Figure 8.1) has emerged providing a suggested implementation plan for the enhanced or improved use of computers in secondary schools for the Western Cape central metropole.

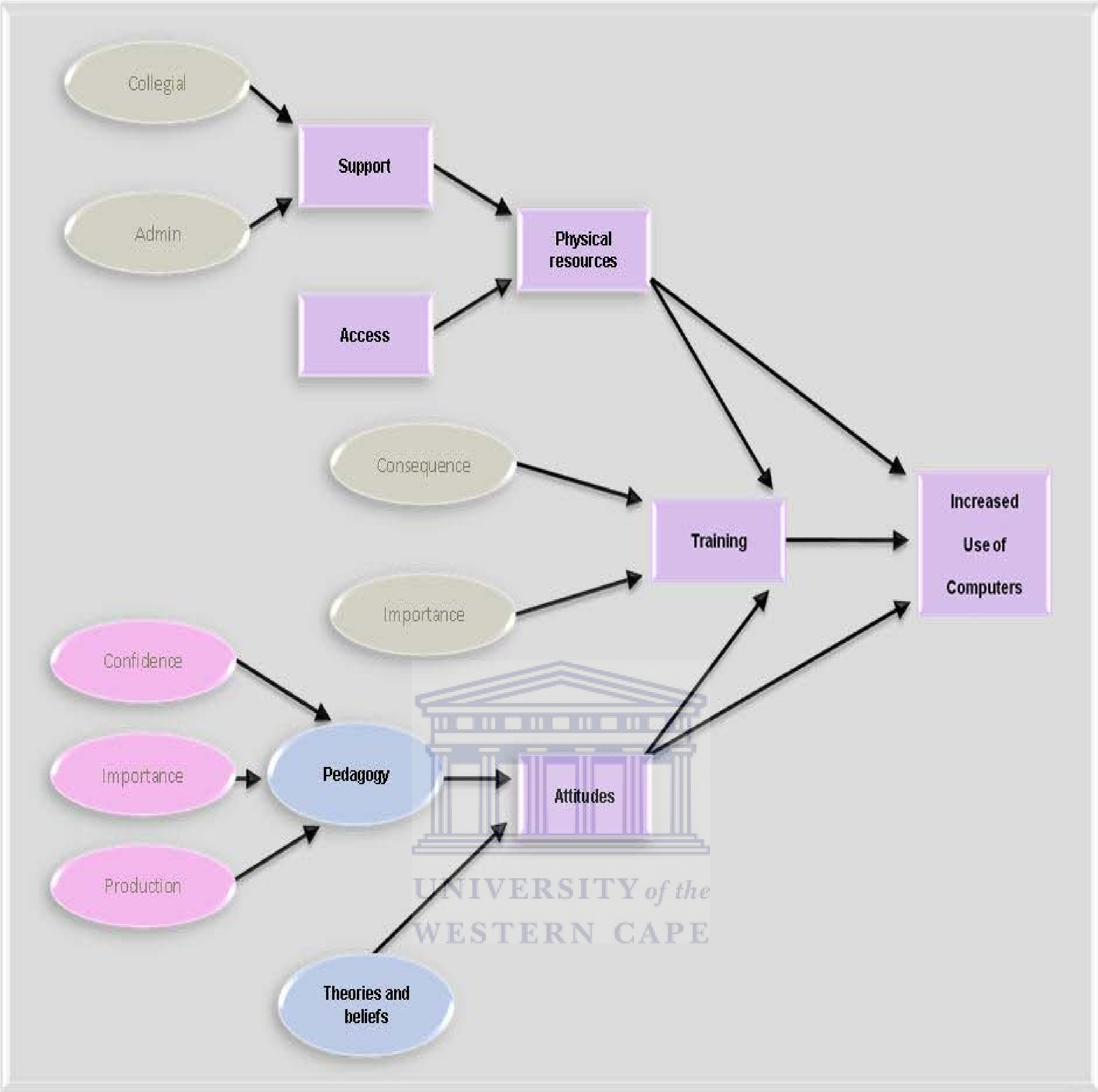

Figure 8.1 Proposed model for increased use of computers in Western Cape secondary schools

8.14 Discussion on the proposed model of improved computer use in secondary schools

The proposed model on increased computer use in secondary schools which emanated from the findings of this research (see Figure 8.1) provides an understanding about the relationships of the determinants and improved use of computers in schools.

Two latent variables namely collegial and administration support are 'greyed out' in the model contained within ellipses. In the model building guidelines, variables that are contained in ellipses are often termed 'latent' variables because they lay 'hidden' and are not really the main predictors of an outcome. Nevertheless, in this study these latent variables acted as supporting variables to the main predictor variables. The predictor or indicator variables are normally contained in rectangular shapes. In the proposed model, the 'greyed out' latent variables illustrates that the results of the quantitative analysis did not find significant support for it, but the qualitative analysis did. According the quantitative and qualitative findings of this study, these two latent variables (i.e. collegial and administration support) contributed to the actual support required by educators for improved use of computers.

The support and access variables have been collapsed into one variable and consequently labelled as 'Physical resources' because it was found that these two variables were the extrinsic contributors to the increased use of computers. Physical resources as argued by the principals of many schools seem to have an impact in the use of computers. Physical resources are those such as computer hardware and software and administration support for the educators. Access refers to the location as to where and how educators' are using computers either from school, home, internet kiosks or media centres.

There are two arrows pointing away from physical resources, towards training and increased use of computers. The arrow pointing directly towards increased use of computers implies that once the physical resources have been sufficiently addressed, it is possible to have an increased use of computers in schools. The quantitative results found insufficient support for the training variable.

However, the qualitative results as indicated by most of the principals that more training is definitely required increasing the use of computers. Hence the second arrow points to training first and then to increased use of computers. The latter explanation is strongly suggested for the use of computer implementation in schools.

In addition, there are two latent variables which are 'greyed out' in the model which influenced training namely the consequence of training and the importance of training. As explained above, these two latent variables did not provide a significant contribution from the results of the quantitative results, however rich data was found in the analysis of the qualitative results.

The quantitative results of this study indicated that pedagogy was a major contributor towards increase use of computers. The pedagogy variable contains three indicator variables which are 'not' greyed out and in addition, had a significant influence on pedagogy. Although it may be argued that there should be an arrow directly from pedagogy to increased computers use, the qualitative results suggests that the attitudes of educators should first improve towards computers, and this could be achieved through additional training.

Once the training on educator pedagogy has been completed, it is envisaged that there would be a greater use of computers in schools. The latter explanation applies to educator theories and beliefs as well. First the educators' attitude must change to become more positive towards the use of computers, which can be achieved through additional or specialised training. Accordingly, once the required training has addressed the educators' theories and beliefs, and increased use in computers should be seen.

Educationalists in South Africa can use this model to proactively design interventions targeted at educators that may be less inclined to use computers in their instruction. This proposed model will not only support educators to have better professional practice, personal growth and quality of working life, but it will also help the secondary schools to achieve its ICT educational goals.

The key findings from this research together with the improved computer usage proposed model generated from this research should provide valuable information not only to the Western Cape Education Department but also to the South African Department of Education and may well be applied to other countries in Africa as well.

8.15 Limitations of the study

This study reflects that a comprehensive investigation into the use of computers for instructional purpose was carried out in secondary schools. Furthermore, the study made some successful contributions to the manner in which educators are using computers in their classrooms. However, there were some limitations to the study.

This research was limited to secondary schools under the jurisdiction of the Western Cape Education Department. In addition, the study was limited to the self-reported perceptions of educators teaching in the Western Cape central metropole. This study did not include the participation of learners and parent-governing bodies, whose contributions are equally important in educational innovations.

Another limitation of the study was that it was not logistically possible to include all secondary schools in the Western Cape central metropole. Only schools from the **central** metropole were investigated in this research project. Therefore, although the results of this study may be of value to all schools in South Africa, the results may not be generalised to other provinces of South Africa or even to the Western Province in its entirety. It is important that the findings of this research be tested in other provinces of South Africa.

8.16 Future research

Although the present study has made significant contributions to the body of knowledge regarding educators' use of computers in secondary schools, certain areas still need to be explored.

This study has shown the important effect of educators' pedagogical reasoning on how they use computers in their teaching. The findings show that there is collegial support among educators.

Therefore, further research needs to be conducted on what impact the pedagogical reasoning of one educator has on the other educators' readiness to integrate computers into their teaching.

Future research can also study the relationship between educators' use of computers and the learners' achievement.

Research is further required to determine whether the educators' theories, beliefs, values, attitudes and pedagogies will change with experience.

The use of internet-based educational training and its impact on learning outcomes in educators with different levels of computer skills is an area that warrants further investigation.

Finally, this study represented only a 'snapshot' of an evolving computer environment in schools. Longitudinal studies will be important to discover trends in the strategy of future information, communication and technological educational endeavours, which must include all educators, principals, school governing bodies and the administration.

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APPENDIX A

THE EDUCATORS' QUESTIONNAIRE

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THE PRINCIPALS' QUESTIONNAIRE

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THE LIST OF QUESTIONS EXTRACTED FROM THE LITERATURE STUDY

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APPENDIX L

LETTERS OF PERMISSION TO USE PREVIOUSY VALIDATED QUESTIONNAIRES

UNIVERSITY of the
WESTERN CAPE

UNIVERSITY OF THE WESTERN CAPE
Private Bag X17, Modderdam Road, Bellville, Cape Town, 7535

Faculty of Economic and Management Sciences
Department of Information Systems

Questionnaire Survey

Monday, 20th July 2009.

Dear Educators,

I am a PhD student under the supervision of Professor Louis Fourie in the Department of Information Systems at the University of the Western Cape.

We would like to request you to avail yourself to be part of our research study. This study that I am conducting entitled: **The use of computers among secondary school educators in the Western Cape central metropole.**

Although anecdotal evidence abounds, there has been no formal evaluation of the above issues. This is of particular importance in view of the challenges facing educators in the delivery of education in South Africa. Research in this field is of cardinal importance if we are to understand how to optimally manage a vital resource in the educational sector – our educators!

This research project aims to facilitate a better understanding of the issues that are important to you, our educators.

I shall appreciate having information from you about the use of computers in your classes. This study will require that you complete a questionnaire survey comprising five pages, along with any additional comments you feel will be helpful. The questionnaire is designed for easy and quick completion and should take no more than 15 minutes.

Your name and any of the information you provide will be kept strictly confidential and nothing will be attributed to any individual or organisation that I am going to deal with. All responses will be stored in a secure environment.

The results of this research will be used for academic purposes only. Your help will be greatly appreciated. Thank you very much for your time and cooperation.

Yours sincerely

Visvanathan Naicker

Any queries about your participation in this study may be directed to the researchers:

Professor Louis Fourie - (021) 9593248 email: lfourie@uwc.ac.za
Visvanathan Naicker - 083 557 6805 email: vnaicker@uwc.ac.za

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Principal Questionnaire

The purpose of this survey is to examine the use of computers for instructional purposes by secondary school educators in the Western Cape Central Metropole

This questionnaire is derived from well-validated portions of several surveys that have been used with principals in the past. Your responses will help to develop a profile of how teachers view technology. This should require about 15 minutes of your time. Usually it is best to respond with your first impression, without giving a question much thought. Your answers will remain confidential. With your permission, this conversation will be digitally recorded.

1. Personal information (Please mark an "X")

1. What is your gender?	Male	Female

2. What is your age?	20-29	30-39	40-49	50-59	60 years or older

3. What is your highest educational qualification?					
Certificate	Diploma	Bachelor's degree	Masters degree	Doctorate	Other

4. How many years of teaching experience do you have at the secondary school level?				
1-5	6-10	11-15	16-20	21 years or more

5. How many years have you used computers in your instruction?				
Less than 1	1-3	4-6	7-10	11 years or more

2. How many educators are there in your school?

………………………………………………

3. Does your school have a policy on the use of computers? Please tick one.

Yes	No

a) If the answer is ***yes***, what is the essence of this policy?

………………………………………………………………………………………

b) If the answer is ***no***, please provide your reasons why there is no policy on the use of computers.

………………………………………………………………………………………

4a. What is your priority regarding computers as an additional medium through which learners are taught? Please tick one.

High	
Average	
Low	

4b. What are your reasons for this priority?

………………………………………………………………………………………

5a. Computers are expensive to buy and to maintain. Who do you think should be responsible for this?

………………………………………………………………………………………

5b. Why do you think so?

………………………………………………………………………………………

6a. Are the computers in your school being utilised to its fullest capacity?

Yes	No

6b. If the answer is yes, please explain how you believe that the computers are being fully utilised.

………………………………………………………………………………………

6c. If the answer is ***no***, why are they not being used effectively?

………………………………………………………………………………………

7. Would you agree with the following statement? The use of computers for instructional purposes enhances learning. Why do you agree or disagree?

………………………………………………………………………………………

8a. Do you have a computer technician/ administrator that provides support to the educators in your school?

Yes	No

8b. If yes, does it matter if this person is full-time and on-site?

………………………………………………………………………………………

8c. If you do not have one, then who provides the technical support to your school?

………………………………………………………………………………………

9a. How often are computer-in-service courses or workshops organised for your educators?

………………………………………………………………………………………

9b. What kinds of topics are covered?

………………………………………………………………………………………

9c. Is it mandatory that all educators attend training sessions?

Yes	No

9d. If no, please explain why?

………………………………………………………………………………………

10. As you may know, the Khanya project is about technology in education. In your view, how successful was this project?

………………………………………………………………………………………

11. Has there been any resistance from educators in your school regarding the use of computers in instruction?

…………………………………………………………………………………….

12. In your opinion, what factors would enhance the experience of computer aided instruction for learners?

……………………………………………………………………………………

13. What factors do you think would enhance the teaching experience of educators when utilising computers in instruction?

…………………………………………………………………………………….

If you have any additional comments you wish to make, please feel free to add them here.

Thank you for your time and cooperation
If you have any questions regarding this survey, please contact the researcher, Mr. V. Naicker, through any of the following.

vnaicker@uwc.ac.za – 0835576805 – (021) 5510994 – (021) 9593226

or

my supervisor, Prof Louis Fourie on (021) 959 3248 or lfourie@uwc.ac.za

UNIVERSITY OF THE WESTERN CAPE
Private Bag X17, Modderdam Road, Bellville, Cape Town, 7535

Faculty of Economic and Management Sciences
Department of Information Systems

From: Mr Visvanathan Naicker
Faculty of Economic and Management Sciences
Department of Information Systems
University of the Western Cape
Private Bag X17
Bellville
CAPE TOWN
7535

Office: (021) 959-3226
Home: (021) 551-0994
Mobile: 083 557 68 05
Email: vnaicker@uwc.ac.za

To: The Principal

Tuesday, 28 July 2009

RE: Conducting research in your school.

I am presently a PhD student and lecturer at the above institution. My research involves the use of computers for instructional purposes by secondary school educators in the Western Cape Central Metropole. My research includes collecting data that will form part of my PhD degree.

The purpose of this letter is for you to allow me an opportunity to visit your school between 27th July and 30th September 2009 to administer questionnaires to your educators. In addition, I humbly request 20 minutes of your time for an interview with you. A letter from the WCED allowing me to do this research in your school has been granted, which I will bring with me on the day of the interview.

Thanking you in advance for your co-operation.

Visvanathan Naicker

UNIVERSITY OF THE WESTERN CAPE
Private Bag X17, Modderdam Road, Bellville, Cape Town, 7535

Faculty of Economic and Management Sciences
Department of Information Systems

From: Mr Visvanathan Naicker
Faculty of Economic and Management Sciences
Department of Information Systems
University of the Western Cape
Private Bag X17
Bellville
CAPE TOWN
7535

To: The Director: Education Research
Western Cape Education Department
Private Bag X9114
CAPE TOWN
8000

07 June 2009

Dear Dr. Ronald Cornnelissen,

RE: Permission to conduct research in secondary schools.

I am presently a PhD student and lecturer at the above institution. My research involves the use of computers for instructional purposes by secondary school educators in the Western Cape Central Metropole. My research work includes collecting data that will form part of my PhD degree.

The purpose of this letter is to request you to kindly grant me permission to allow me to deliver a survey questionnaire to be completed by the secondary school educators in 65 secondary schools in the Western Cape central metropole.
In addition, I would like to conduct a 20 minute interview with the principals of these schools, requesting their views of computer use in their schools.

The information obtained will be necessary for assessing how educators are using computers for teaching and learning in secondary schools.

Furthermore, I also seek permission to pilot my questionnaire at XXX Senior secondary school (metropole xxx), before administering it to the WC central metropole schools.

The study will be conducted from the 1st July 2009 until the 30th September 2009.

I have attached the following documents for your kind perusal:

1. The 65 schools where I intend to administer the questionnaires.
2. The Educator Questionnaire, which is quantitative in nature.
3. The Principal Questionnaire, which is qualitative in nature.

In case of any questions or concerns you may have, please do not hesitate to contact me on the details below or my supervisor, Prof Louis Fourie, at (021) 959-3248 or lfourie@uwc.ac.za

Thanking you in advance for your co-operation

Yours sincerely

Mr Visvanathan Naicker

Email: vnaicker@uwc.ac.za

Mobile: 083 557 68 05
Tel. Office: 021- 959 322 6
Tel. Home: 021- 551 099 4

UNIVERSITY of the WESTERN CAPE

UNIVERSITY OF THE WESTERN CAPE
Private Bag X17, Modderdam Road, Bellville, Cape Town, 7535

Faculty of Economic and Management Sciences
Department of Information Systems

Confirmation of Questionnaire Delivery / Collection

To Whom It May Concern:

We hereby confirm that Mr Visvanathan Naicker has delivered / collected his questionnaires for his PhD study at this school.

Name of School:…………………………………………………………………………………

Received By :……………………………………………….. Date:………………………

Date Collected:…………………….............

UNIVERSITY of the WESTERN CAPE

Educator Questionnaire

The purpose of this survey is to examine the use of computers in instruction by secondary school educators in the Western Cape Central Metropole

This questionnaire is derived from well-validated portions of several surveys that have been used with educators in the past. Your responses will help to develop a profile of how educators view technology. Please complete all items even if you feel that some are redundant. This should require about 15 minutes of your time. Usually it is best to respond with your first impression, without giving a question much thought. Your answers will remain confidential and anonymous.

1. Personal information (Please mark an "X")

What is your gender?	Male	Female

What is your age?	20-29	30-39	40-49	50-59	60 years or older

What is your highest qualification?					
Certificate	Diploma	Bachelor's degree	Masters degree	Doctorate	Other

How many years of teaching experience do you have at the secondary school level?				
1-5	6-10	11-15	16-20	21 years or more

How many years have you used computers in your instruction?				
Less than 1	1-3	4-6	7-10	11 years or more

2. Please mark an "X" next to the instructional method that you use. (choose only one)

1.		largely teacher-directed (e.g., teacher-led discussion, lecture)
2.		more teacher-directed than student-centred(e.g., co-operative learning, discovery learning)
3.		even-balanced between teacher-directed and student-centred activities
4.		more student-centred than teacher-directed
5.		largely student-centred

3. How would you describe yourself in respect to the various levels of computer usage? Mark an "X" next to the level that best describes you.

1.		Unfamiliar	I have no experience with computer technologies.
2.		Newcomer	I have attempted to use computer technologies, but I still require help on a regular basis.
3.		Beginner	I am able to perform basic functions in a limited number of computer applications.
4.		Average	I demonstrate a general competency in a number of computer applications.
5.		Advanced	I have acquired the ability to competently use a broad spectrum of computer technologies.
6.		Expert	I am extremely proficient in using a wide variety of computer technologies.

4. Please indicate your beliefs about the use of computers in your interaction with students as expressed in each of the following statements by selecting *__one__* level of agreement or disagreement.

SD = Strongly Disagree (1)	**D = Disagree**(2)	**U = Undecided**(3)	**A = Agree**(4)	**SA = Strongly Agree**(5)

	SD	D	U	A	SA
1. Using computers has changed the way in which I relate to the learners.	①	②	③	④	⑤
2. My biggest fear in using computers in the class is the embarrassment in front of my learners.	①	②	③	④	⑤
3. My biggest fear in using computers during lessons is losing control of the class.	①	②	③	④	⑤

SD = Strongly Disagree (1)	D = Disagree(2)	U = Undecided(3)	A = Agree(4)	SA = Strongly Agree(5)

	SD	D	U	A	SA
4. I sometimes feel that I have been left behind when it comes to using computers.	①	②	③	④	⑤
5. I am afraid that if I begin to use computers I will become dependent upon them and lose some of my reasoning skills.	①	②	③	④	⑤
6. There is insufficient evidence to support the belief that when educators use computers for instructional purposes, it benefits the learner.	①	②	③	④	⑤
7. Schools cannot expect us to learn all this new computer technologies without giving us extra pay.	①	②	③	④	⑤
8. I have made progress during the past year in learning new computer skills.	①	②	③	④	⑤
9. Teaching with computers offers real advantages over traditional methods of instruction.	①	②	③	④	⑤
10. Using computer technology in the classroom would make the subject matter interesting.	①	②	③	④	⑤
11. It would be hard for me to learn to use the computer in teaching.	①	②	③	④	⑤
12. Computers complicate my task in the classroom.	①	②	③	④	⑤
13. Using computers makes preparation for lessons time-consuming.	①	②	③	④	⑤
14. Using computers in school makes the academic environment intellectually stimulating.	①	②	③	④	⑤
15. Using computers in school makes my administration efficient.	①	②	③	④	⑤
16. Computers have often disrupted my lessons due to problems with hardware.	①	②	③	④	⑤
17. Computers have often disrupted my lessons due to problems with software.	①	②	③	④	⑤
18. Using computers results in learners neglecting important traditional learning resources (e.g., library books).	①	②	③	④	⑤
19. Using computers in teaching is difficult because some learners know more about computers than educators.	①	②	③	④	⑤
20. Computers could reduce the number of educators employed in the future.	①	②	③	④	⑤
21. Using computers gives educators the opportunity to be learning facilitators, instead of information providers.	①	②	③	④	⑤
22. I am excited about using computers in my work as an educator.	①	②	③	④	⑤

5. Please indicate *how often* you have access to computers in the following contexts by selecting only *one* appropriate answer for each statement.

N = Never (1)	R = Rarely (2)	S = Sometimes (3)	O = Often (4)	VO = Very Often (5)

How often do you have access to …?	N	R	S	O	VO
1. A computer at your workspace in school with educational software installed for teaching purposes.	①	②	③	④	⑤
2. Technological equipment (e.g. scanners, proxima's, whiteboards, printers) in your classroom for teaching purposes.	①	②	③	④	⑤
3. A computer lab.	①	②	③	④	⑤
4. A computer at your home.	①	②	③	④	⑤
5. A computer in a media centre.	①	②	③	④	⑤
6. A compute in a library.	①	②	③	④	⑤

6. Do the following statements affect your usage of computers at school? Please select only *one* appropriate answer for each statement.

N = Never (1)	R = Rarely (2)	S = Sometimes (3)	O = Often (4)	VO = Very Often (5)

	N	R	S	O	VO
1. Not enough computers at school.	①	②	③	④	⑤
2. Insufficient software licenses at school.	①	②	③	④	⑤
3. Obsolete computer equipment, which cannot be used for classroom instruction.	①	②	③	④	⑤
4. The network is frequently down or unavailable.	①	②	③	④	⑤
5. Vandalism of computer equipment in school.	①	②	③	④	⑤
6. Internet access which is not easily accessible at school.	①	②	③	④	⑤
7. Limited classrooms that are suitable for computer equipment.	①	②	③	④	⑤

7. The following items describe the way educators at school feel about the use of computers in education. Please select only *one* level of agreement or disagreement for each statement.

SD = Strongly Disagree (1)	D = Disagree (2)	U = Undecided (3)	A = Agree (4)	SA = Strongly Agree (5)

	SD	D	U	A	SA
1. Computers do not scare me at all.	①	②	③	④	⑤
2. Computers are fast means of getting information.	①	②	③	④	⑤
3. I prefer to deliver lessons using computers.	①	②	③	④	⑤
4. I think that working with computers would be stimulating.	①	②	③	④	⑤
5. The challenge of learning about computers is exciting.	①	②	③	④	⑤
6. Computers do more harm than good.	①	②	③	④	⑤
7. I dislike using computers in teaching.	①	②	③	④	⑤
8. I have no intention to use computers for teaching in the near future.	①	②	③	④	⑤
9. Using a computer is very frustrating.	①	②	③	④	⑤
10. I will probably never learn to use a computer.	①	②	③	④	⑤
11. The use of computers in education reduces the personal treatment of learners.	①	②	③	④	⑤
12. Working with computers makes me feel isolated from other people.	①	②	③	④	⑤
13. Computers can help me learn.	①	②	③	④	⑤
14. The challenge of solving problems with computers does not appeal to me.	①	②	③	④	⑤
15. Computers are necessary tools in educational settings.	①	②	③	④	⑤
16. Computers have the potential to control our lives.	①	②	③	④	⑤
17. I see the computer as something I will rarely use in my daily life.	①	②	③	④	⑤

18. Working with a computer makes me nervous.	①	②	③	④	⑤

8. Please indicate your level of support that you are receiving from your school regarding the use of computers as expressed in each of the following statements by selecting only *__one__* level of agreement or disagreement for each statement.

SD = Strongly Disagree(1)	**D = Disagree(2)**	**U = Undecided(3)**	**A = Agree(4)**	**SA = Strongly Agree(5)**

	SD	D	U	A	SA
1. The administration (i.e., principal, head of department and other) provides consistent computer support to educators.	①	②	③	④	⑤
2. The administration provides an on-site computer technician to assist educators in computer use.	①	②	③	④	⑤
3. My colleagues assist me with computer related issues.	①	②	③	④	⑤
4. My colleagues encourage me to use computers.	①	②	③	④	⑤
5. The people who give me the best ideas for improving my teaching also tend to know a lot about using computers.	①	②	③	④	⑤
6. There is a general lack of support to integrate the use of computers into the curriculum.	①	②	③	④	⑤
7. There is sufficient support among educators using web-based programs.	①	②	③	④	⑤
8. There is a lack of technical computer support in my school.	①	②	③	④	⑤
9. There is sufficient support through training in my school.	①	②	③	④	⑤
10. There is sufficient support through educational courses in my school.	①	②	③	④	⑤

9. Have you received any form of computer training? **Yes** **No**

10. If *__no__*, please provide three main reasons as to why you have never received any computer training. If *__yes__*, please continue with question 11.

1]………………………………………………………………………………

2]………………………………………………………………………………

3]……………………………………………………………………………………

11. Please indicate by selecting only *__one__* level, of how strongly you agree or disagree with each of the following statements.

SD = Strongly Disagree(1)	**D = Disagree(2)**	**U = Undecided(3)**	**A = Agree(4)**	**SA = Strongly Agree(5)**

The training I have received has:	**SD**	**D**	**U**	**A**	**SA**
1. Enhanced my computer skills.	①	②	③	④	⑤
2. Allowed me to have useful discussions with other professionals.	①	②	③	④	⑤
3. Given me a greater awareness of teaching materials.	①	②	③	④	⑤
4. Provided me with ideas for using computers in lessons.	①	②	③	④	⑤
5. Allowed me to reflect on my classroom practice.	①	②	③	④	⑤
6. Helped me to change my teaching practice.	①	②	③	④	⑤
7. Helped me to integrate the use of computers in my teaching practice.	①	②	③	④	⑤
8. Enhanced my knowledge of good practice for using computers in lessons.	①	②	③	④	⑤
9. Provided me with insights to improve future staff training programs.	①	②	③	④	⑤

12. Please indicate the extent to which you *__value__* different forms of training. Select only *__one__* level for each statement.

NV = No value(1)	**LV=Low value(2)**	**MV= Medium value(3)**	**HV=High value(4)**	**VHV = Very high value(5)**

	NV	**LV**	**MV**	**HV**	**VHV**
1. Training that covers basic computer skills.	①	②	③	④	⑤
2. Training that covers advanced computer skills.	①	②	③	④	⑤
3. Training that provides ideas for using computers in my subject teaching.	①	②	③	④	⑤

4. Training that address my continuous professional development in computers.	①	②	③	④	⑤
5 Training skills that enhance the use of computers for administration.	①	②	③	④	⑤
6. Training skills that allow me to manage computers in the school.	①	②	③	④	⑤
7. Training that provides information on how to integrate computers in the curriculum.	①	②	③	④	⑤

13. Please indicate how important the computer training was to you. Select only *one* level per statement.

NA = Not at all Important(1)	NV = Not Very Important(2)	I = Important(3)	VI=Very Important(4)	EI = Extremely Important(5)

	NA	NV	I	VI	EI
1. In-house computer training.	①	②	③	④	⑤
2. Computer training programmes conducted by an external consultant at school.	①	②	③	④	⑤
3. Training that has given me confidence in using computers.	①	②	③	④	⑤
4. Training which helps me to analyse information.	①	②	③	④	⑤
5. Training which assists me to communicate with colleagues using e-mail.	①	②	③	④	⑤
6. One-on-one computer training, specific to the subject you are teaching.	①	②	③	④	⑤

14. Please select only *one* level of importance for each statement.

NA = Not at all Important(1)	NV = Not Very Important(2)	I = Important(3)	VI=Very Important(4)	EI = Extremely Important(5)

Computers are used . . .	NA	NV	I	VI	EI
1. To enhance pupils communication skills.	①	②	③	④	⑤
2. To search for information.	①	②	③	④	⑤
3. To promote independent learning.	①	②	③	④	⑤
4. To develop problem-solving skills.	①	②	③	④	⑤
5 To produce work more efficiently.	①	②	③	④	⑤

6. To experiment with new teaching styles.	①	②	③	④	⑤
7. To reflect more on my teaching practice.	①	②	③	④	⑤

15. Please select only *one* level of how knowledgeable you feel you are to do the following.

NA = Not at all knowledgeable(1)	NV = Not Very knowledgeable(2)	K = Knowledgeable(3)	VK=Very Knowledgeable(4)	EK= Extremely Knowledgeable(5)

	NA	NV	K	VK	EK
1. Demonstrate aspects of a topic in your subject through the use of computers.	①	②	③	④	⑤
2. Select appropriate software for the teaching of particular subjects.	①	②	③	④	⑤
3. Use computers to respond to the learning requirements of the national curriculum.	①	②	③	④	⑤
4. Incorporate information from the internet into teaching materials.	①	②	③	④	⑤
5. Combine the use of computers with other conventional media (e.g. text books, handouts).	①	②	③	④	⑤
6. Judge the effectiveness of using computers in achieving teaching objectives.	①	②	③	④	⑤
7. Know how computers can be used in your specialist subject.	①	②	③	④	⑤
8. Know how computers can support your continuing professional development.	①	②	③	④	⑤

16. Please select only *one* level of agreement or disagreement.

SD = Strongly Disagree(1)	D = Disagree(2)	U = Undecided(3)	A = Agree(4)	SA = Strongly Agree(5)

I believe that…	SD	D	U	A	SA
1. It is important for learners to learn about computers in order to be informed citizens.	①	②	③	④	⑤
2. Computers increase my productivity.	①	②	③	④	⑤
3. Computers can be useful instructional aids in all subject areas.	①	②	③	④	⑤
4. Computers will improve education.	①	②	③	④	⑤

5. Computers stimulate creativity in learners.	①	②	③	④	⑤

17. How competent or knowledgeable are you to do the following? Please mark an "X" next to the level that best describes you.

1	**no knowledge or ability**
2	**very limited knowledge or ability**
3	**sufficient for basic tasks only**
4	**good, adequate for most tasks**
5	**very good (confident/competent and knowledgeable)**

	1	2	3	4	5
1. Start and shut down the computer correctly?					
2. Swapping between applications?					
3. Retrieve files from stiffy disks, flash drives and cd-roms?					
4. Copy, delete and rename files?					
5. Understand how a word processor can be used?					
6. Use a word processor in lessons?					
7. Understand how graphics software can be used?					
8. Use a graphics package to prepare teaching materials?					
9. Understand how a spreadsheet can be used?					
10. Use a spreadsheet to prepare teaching materials?					
11. Understand how a database can be used?					
12. Use databases in lessons?					
13. Use content specific software in lessons?					
14. Understand how the World Wide Web (www) can be used?					
15. Use the World Wide Web to support your teaching?					
16. Understand how e-mail can be used?					
17. Participate in "real-time" discussions, e.g., in a chat room.					
18. Understand how to use a proxima / projector?					

If you have any additional comments you wish to make, please feel free to add them here.

Thank you for your time and cooperation.
If you have any questions regarding this survey, please contact the researcher, Mr. V.Naicker through any of the following.
vnaicker@uwc.ac.za – 0835576805 – (021) 5510994 – (021) 9593226

or my supervisor Prof. Louis Fourie on (021) 9593248 or lfourie@uwc.ac.za

Navrae
Enquiries **Dr RS Cornelissen**
IMibuzo

Telefoon
Telephone **(021) 467-2286**
IFoni

Faks
Fax **(021) 425-7445**
IFeksi

Verwysing
Reference **20090624-0051**
ISalathiso

Wes-Kaap Onderwysdepartement

Western Cape Education Department

ISebe leMfundo leNtshona Koloni

Mr Visvanathan Naicker
Economics and Management Sciences
University of the Western Cape
Private Bag X17
BELLVILLE
7535

Dear Mr V. Naicker

RESEARCH PROPOSAL: THE USE OF COMPUTERS AMONG SECONDARY SCHOOL EDUCATORS IN THE WESTERN CAPE CENTRAL METROPOLE.

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

1. Principals, educators and learners are under no obligation to assist you in your investigation.
2. Principals, educators, learners and schools should not be identifiable in any way from the results of the investigation.
3. You make all the arrangements concerning your investigation.
4. Educators' programmes are not to be interrupted.
5. The Study is to be conducted from **25th June 2009 to 30th September 2009**.
6. No research can be conducted during the fourth term as schools are preparing and finalizing syllabi for examinations (October to December).
7. Should you wish to extend the period of your survey, please contact Dr R. Cornelissen at the contact numbers above quoting the reference number.
8. A photocopy of this letter is submitted to the principal where the intended research is to be conducted.
9. Your research will be limited to the list of schools as forwarded to the Western Cape Education Department.
10. A brief summary of the content, findings and recommendations is provided to the Director: Research Services.
11. The Department receives a copy of the completed report/dissertation/thesis addressed to:
    The Director: Research Services
    Western Cape Education Department
    Private Bag X9114
    CAPE TOWN
    8000

We wish you success in your research.

Kind regards.

Signed: Ronald S. Cornelissen
for: **HEAD: EDUCATION**
DATE: 25th June 2009