

UNIVERSITY OF KWAZULU-NATAL

THE EFFECTIVE USE OF COMPUTERS AND EMERGING TECHNOLOGIES FOR E-EDUCATION IN PUBLIC SECONDARY SCHOOLS IN URBAN AND RURAL COMMUNITIES OF KWAZULU-NATAL

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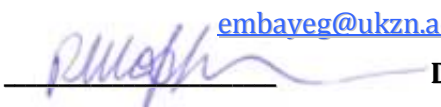
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DEDICATION

I dedicate this thesis to my parents and my friends and to the Capuchin Friary in Eritrea (East Africa) who sponsored me to study at the University of KwaZulu-Natal.

DECLARATION

I**Ghebre Embaye Woldu**declare that

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ABSTRACT

University of KwaZulu-Natal

THE EFFECTIVE USE OF COMPUTERS AND EMERGING TECHNOLOGIES FOR
E-EDUCATION IN PUBLIC SECONDARY SCHOOLS IN URBAN AND RURAL
COMMUNITIES OF KWAZULU-NATAL

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This study identifies problems and competencies, with the aim of establishing whether educators would be willing to adopt e-Education; and be ready to implement the policy in the classroom, as well as the acceptance of Information and Communication Technologies (ICT) in public secondary schools in urban and rural communities of KwaZulu-Natal. The focus of the study is on basic as well as emerging technology that teachers need to use for a range of educational applications.

The quantitative research methodology was used to conduct the study, using a questionnaire as data gathering survey instrument. The sample of the population consists of 300 respondents in the rural and urban communities of KwaZulu-Natal. The data was analysed and processed using SPSS and MS Office Excel application software.

The study forms part of a coordinated research project in which a group of researchers measured the degree of readiness (e-Readiness) of educators and learners to effectively use Information and Communication Technologies for e-Education, as proposed in the South African Government's 2003 White Paper on e-Education. The results of the

present project indicate that teachers in KwaZulu-Natal are willing to implement e-Education and ready to use emerging technologies for the effective learning and teaching environment, but that their skills at using Information and Communication Technologies need upgrading to advance electronic communications and computer equipment.

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ACRONYMS

ACCE	Australian Council for Computer Education
ADSL	Asymmetric Digital Subscriber Line
CAI	Computer Assisted /Aided Instruction
CAL	Computer-Aided Learning
CALM	Computer-Aided Learning in Mathematics
CARET	Centre for Applied Research in Education Technology
CAT	Computer Application Technology
CALT	Computer-Assisted Language Term
CBE	Computer-Based Education
CBI	Computer-Based Instruction
CBT	Computer-Based Training
CBL	Computer-Based Learning
CMC	Computer-Mediated Communication
CMI	Computer Managed Instruction
CPU	Central Processing Unit
DE	Distance Education
DoC	Department of Communication
DoE	Department of Education
EAC	East Africa Community
EMA	Ethekwini Municipal Area
ECOWAS	Economic community of West African States
ELRC	Education Labour Relations Bargaining Chamber
E-mail	Electronic Mail
EMIS	Education Management Information System
EU	European Union

GPS	Global Positioning System
ICDL	International Computer Driving License/ International Children's Digital Library
IBI	Internet-Based Instruction
ICT	Information and Communication Technology
ILS	Integrated Learning Systems
IS	Information Systems
ISP	Internet Service Provider
ISTE	International Society for Technology in Education
IT	Information Technology
KZN	KwaZulu-Natal
MIS	Management Information System
MIT	Massachusetts Institute of Technology
NCES	National Centre for Educational Statistics
NEPAD	New Partnership for Africa's Development
NIC	Network Interface Card
OMR	Optical Mark Reader
OPAC	Online Public Access Catalogue
PC	Personal Computer
PDA	Personal Digital Assistant
RAM	Random Access Memory
ROM	Read Only Memory
RFID	Radio Frequency Identification Device
SADC	Southern Africa Development Community
SMME	Small Medium & Micro Enterprise
SMS	Short Message Service
TBT	Technology Based Training
VANS	Value Added Network Services

VoIP Voice-over Internet Protocol
UMA Arab Maghreb Union
UNESCO United Nations Educational Scientific & Cultural Organization
UPC Universal Product Code
URL Uniform Resource Locator
USB Universal Serial Bus
WBI Web Based Instruction
WWW World Wide Web

Chapter 1

STATEMENT OF PROBLEMS AND RESEARCH DESIGN

1.1 INTRODUCTION

This thesis forms part of a coordinated group research project that focuses on the introduction of electronic education (e-Education) in public schools in the KwaZulu-Natal province of South Africa. In line with the other studies in the project, this thesis focuses on the concept of e-Readiness – the degree of readiness of educators to utilize Information and Communication Technologies to deliver knowledge-centric education in classrooms.

In 2003 the South African government determined that by 2013 all public schools in the country should be e-Schools, entailing that a variety of forms of electronic education should be employed in classrooms, including the electronic management of school administration as described in White Paper on e-Education. The South African government has been playing a great role to improve the learning environment for high schools. Against this background the general purpose of the proposed research project is to determine how prepared teachers in KwaZulu-Natal public schools in urban and rural communities are to implement e-Education in teaching and school administration (Betsy, 2003).

According to an anonymous spokesperson in the Finland EU Presidency (2006) at the Information Society Conference “i2010 towards a Ubiquitous European Information Society”, held in Espoo, Finland, on 27 – 28 September 2006, everyday lives are increasingly influenced by Information and Communication Technologies (ICTs),

whereby everyone can be connected with everyone else, with everything, whenever and wherever they please. It is envisaged that such ubiquitous communication will improve the quality of the everyday life of citizens and will provide new means for businesses and public administration to be more efficient. Ongoing policies should entail the advantages for new services presented by new technologies, such as, Information and Communication Technologies (ICT), the Radio Frequency Identification Device (RFID) for remotely retrieving data and Asymmetric Digital Subscriber Line (ADSL) to promote the fast growing broadband coverage systems in the rural communities of schools. All those existing services that combine built-on devices, such as mobile and micro payment, e-invoicing and e-procurement, could be more widely deployed. The ability of two or more systems or components to exchange information (Interoperable identification methods) should be elaborated on to enhance the usage and efficiency of such services, improving in particular the quality, transparency and productivity of numerous areas within society (Finland's EU president, 2006).

As Capron and Johnson (2002) note the computer has been widely used in education. Computers in the business world have become an essential part of many daily tasks (e.g. payrolls, data processing, online information, etc.). Technology can therefore be used in every aspect of business and in various ways. The use of technology in education generally affects the types of storage, communication, software, and the input of data on which running e-Learning depends. The role of technology in society is seen everywhere and becoming increasingly sophisticated. Gaining a solid understanding of the theory and practice that highlights the incredible technological advances of the last half century would be a good preparation and understanding for making a future impact.

As Morley and Parker (2007) state, many years ago computers were used by few people, mainly researchers and scientists. Computers and the Internet are frequently used to obtain information, listen to music, watch TV and movies, play online games, buy or sell products and service online, communicate with others and much, much more. Many people carry a computer, cell phone, or other electronic device with them at all times so they can remain in touch with others on a continual basis and have access to Internet information when they need it.

Teachers and learners can use computer-based tools, such as text or graphic editors, databases, spreadsheets, or presentation packages, to help in processing information in their work environment. Teachers can enhance their display presentations with rich graphics, images, tables, and audio-visuals which can be saved and stored in their computers, easily updated, and readily accessible for presentation at suitable times to the whole class by means of a projection device. Learners can also interact with the soft copy of work that are stored in portable and removable storages such as floppy disks, USB flash drives, CDs or through e-mail, thereby allowing the teacher to interact with the learners for comment and suggestions and return it to the learners for adjustments until a satisfactory final draft has been achieved. In this way teachers and learners get used to working with the tools that permeate industrial, commercial and intellectual life (Osin, 1998).

Educators, at all grade levels, are using computers to provide students and learners with instantaneous access to information via online sources around the globe (Fallows & Rainie, 2004). As a result of this, the researcher would like to examine the benefits of the effective and efficient use of computers in schools. The computer as a tool needs to create possible outcomes in education so that schools could be academically excellent and innovative. If the computer is not used

properly it can cause problems, by abusing it rather than using it. It is therefore a matter of how to deal with computers to solve problems in implementing e-Learning efficiently and effectively in KwaZulu-Natal (KZN) public secondary schools.

Knowing how computers are effectively used, could benefit every single educational institution. This could improve the possibility of exchanging information and allow for broad scope of interlinking education among schools. Managers use different project management software to create, manage and share tasks that include features of time tracking, reporting, email notification, Gantt charts, access rights, document management, calendar and even send via LANs or Internet. Most upper-level managers are involved in some kind of project (e.g. Task Management System). These projects can be time consuming. The use of computers can assist users to ensure that their project is performed efficiently and effectively. Therefore, knowing how to properly use computers can be one of the most valuable keys for solving business problems (Morley & Parker, 2007).

In short, the motivation to study the topic is to support schools activities, in order to help the teacher acquire the basic knowledge and skills to be elaborative, judge and act independently, and develop "Academic Ability", including a problem-solving ability under new and emerging technologies. Furthermore, as Bengu (1996) affirms in his White Paper on Education, education and training must revolutionize and aim to change; if the teaching system is not dynamic, it cannot be business as usual in schools, colleges, technikons and universities. The national project of reconstruction and development compels everyone in education and training to accept the challenge of creating a system which cultivates and liberates the talents of all people, without exception.

1.2 STATEMENT OF PROBLEMS

This section deals with the overall general statement of problems which is then decomposed into subproblems that can be individually subjected to empirical investigation. In the words of the researcher's supervisor: "In order to formulate a proper problem statement, one must envisage two real-world scenarios: in the background envisage a scenario in which an ideal problem-free system is functioning optimally, and in the foreground, as target of one's research, envisage a scenario in which specific problems are causing the ideal system to be dysfunctional" (Klopper, 2008).

1.2.1 Overall problem statement

For the quality of education to be improved, the teachers need to command the skills of using Information and Communication Technologies (ICTs) which can facilitate the learning system to achieve to the best of the objectives using technologies to express and convey learning knowledge. This means they should know the computer components; how effective, compatible and powerful they are, because it is a key point when deciding how information can be translated into comprehensible knowledge or whether it is worthwhile and matter-of-fact to be utilized and implemented by public secondary schools. Phillips (2000) argues that teachers will have to acquire new skills in order to meet the requirements of providing open and flexible learning by using the new communications technology.

Computer literacy is an agreed prerequisite for all students and teachers, whether young or old (Eisenberg & Johnson, 2002). Since the influx of computers into homes and schools, the demand for the teaching of "computer literacy" in school has increased dramatically (Eisenberg & Johnson, 2002). Computer literacy is, in its most basic

form, “the ability to work with computer applications, hardware and communication systems with no or little assistance” (Mokhesi, 2000).

According to Phillips (2000) most efforts of teachers are at present aimed towards the presentation and delivery of subject matter and knowledge, with less being dedicated to consolidation, facilitation, remediation and assessment of learning outcomes. With the development of learning technology, and the subsequent increasing reliance on computer-based learning resources, less time will be needed for preparation and delivery, allowing more time for ensuring and enhancing the learning outcomes. This shift requires a considerable role change for teachers and should be viewed as job enrichment in so far as consolidation, remediation and assessment are just as demanding and rewarding as presentation. This role change for teachers needs to be nurtured through strong staff development programs.

Computer skills training in public secondary schools in urban and rural communities of KwaZulu-Natal is important for learners as well as teachers before e-Education can be successfully introduced. For example, as it was pointed out in a study of the Australian council for computer education, a computer with the most sophisticated software will not be fruitful without trained teachers to operate it (Australian Council for Computer Education (ACCE), 2005). A great deal of professional development regarding to computer skills to interact with societies using digital technologies such as Internet, cell phones, PDAs and other digital devices was done among teachers in the early 1980's. However, the advances in technology since that time have been just as considerable, but professional development in the area has tapered off (Australian Council for Computer Education (ACCE), 2005).

The knowledge society is a society continuously involved in the learning process, in which knowledge and competences go forward. Teachers and students as part of this society of continual learning will

have to keep on learning throughout their careers. Contemporary society needs new knowledge and new tangible skills for lifelong learning as described by Cornu (2005) in his workshop 3, “European Testing Conference on Common European Principles for teachers’ competences and qualifications”. Technology is a major challenge for schools and for teachers all over the globe. There is a need to prepare teachers and learners for effective use of technologies and give them the capacity to carry on with lifelong learning. The teaching career for computer skills are in a steady state of development involving comprehensible knowledge, new skills and competences, teachers can only teach if they are learning continuously; if they cannot continue to learn, they cannot deliver fundamental teaching to learners. This continuum, which begins with early teacher education, is now an essential element of the teaching profession.

Although there has been a strong boost to get educational technology into the hands of teachers and learners, many barriers to implementation still exist. Computer equipment may not be placed in easily accessible locations. Hardware and software often create problems for teachers in the classroom, and immediate technical support may be unavailable whenever it is needed. Teachers may be short of the time and the motivation to learn technology skills. Professional development activities may not provide enduring, computer hands-on training for teachers or practical strategies for implementing technology into lesson plans. The ongoing financial support may not be sustained and thus not capable of providing upgrades, maintenance, and ongoing professional development. Fortunately, these obstacles can be addressed and overcome if they are dealt with early. This critical issue provides practical information for promoting technology use in schools (Gahala, 2001).

Without continuous technical support, technology integration in the classroom will never be satisfactorily achieved. As Gahala (2001)

states, without technical support most teachers will end up with equipment failure, software complexity, data loss, embarrassments, and frustration. Teachers do not want to be left behind with learners wondering why it is not working the way it is supposed to be. When they are trying to use technology in their classrooms and they encounter difficulties, teachers need immediate help and support. Therefore, helping technology users while they are actively engaged with technology at their work location is probably the most meaningful, essential and appreciative support that can be provided.

Not only in education but generally in business, communication networks are essential. Communication technology has a tremendous impact on learning. Communication tools allow for virtual interaction between learners and learners and between learners and educators over large distances (Macdonald, 2002). Schools must have the basic background infrastructure for setting communication within themselves and throughout other schools. By knowing how many schools do and do not have basic Information Communication and Technology infrastructures, learners and teachers could get access and rights to basic communications such as telephone and Internet at schools.

Technology has been an essential part of improving school academic achievements. The greatest contribution that learning technology can make to improving the effectiveness of learning rests in its ability to support active learning, and to facilitate cost-effective forms of educational dialogue (Parusnath, 2002). Although the use of computers is very important, the online activities such as accessing games, watching movies and listening to musics may at times detract purposeful learners and teachers from doing their jobs. Therefore, it is crucial to get criticism and feedback from the most and least important computer system users.

The researcher actually would like to know what are the possible problems related to information systems experienced by the teachers

in their education in public secondary schools in urban and rural communities of KwaZulu-Natal. For example, in globally networked computer societies should know how stakeholders trust information processing on connected computers, or effectively protect data against remote cyber attacks? In addition, one also needs to consider the potential of securing computational devices so that they can be trusted to operate undisrupted, despite actions by potential adversaries.

The issues of computer security for effective use are very important in business and education. Schmitt (2008) affirms the rise of computer-related criminal activity in the modern marketplace. In fact, she says that the Oklahoma-based group has listed cyber crime prevention as an industry focus in 2008. The emerging information infrastructure requires a more complicated network computer system. In business organizations multiple parties spanning multiple organizations have various opinions about what they might trust and in what contexts. To be effective, the underlying mechanics for transmitting, storing, processing and expressing assertions about these parties need to be able to provide the right parameters to accommodate this multiplicity of views. When a computer links to a network and begins communicating with other computers, it is essentially vulnerable to one or more security issues. Cyber criminals know that a successful attack can be very profitable. This means they will always strive to find new ways and break-in IT securities; likewise this can be applied to the school environment, as disgruntled learners may decide to crack the system for adjustment to their marks; therefore, security being an important feature, it would be necessary to find out how the teachers save marks and confidential documents at schools.

Presently modern technology has changed and will still change the way users collect data, transact business, and entertain themselves. Computers changed the way people learn, study and communicate. The Australian Council for Computer Education (2005) identi-

fies that Information technology in schools can be seen in curriculum, management, architectural and systemic issues. The quality of this environment is essential for their effective deployment and successful application to the business of learning backgrounds. Therefore, the researcher will like to investigate whether computers are incorporated in the work environment and available for teachers to perform better. The computer is an effective tool to be utilized by learners and teachers who work at public secondary schools in KwaZulu-Natal.

Finally this research will investigate what improvements have been achieved so far and what can be suggested for further improvement and implementation. Besides all those problems mentioned above such as accessibility, availability, security, hardware systems and competency skills, and ICT infrastructure implementations, the research will also investigate the advantages and disadvantages of using computer technologies. Obviously other related questions will inevitably emerge during the research phase as well.

1.2.2 Subproblems

The above general problem can therefore be restated as the following subproblems:

- 1) There is a rapid increase in knowledge and information in the 21st century thus; at present what levels of knowledge are necessary for teachers to be able to use emerging and existing Information and Communication Technologies in e-Education.
- 2) Schools need to be part of the modern information networks and that will require technology platforms and infrastructure thus; at present what types of network access do teachers and learners have at public secondary schools in urban and rural communities of KwaZulu-Natal to access knowledge resources.

- 3) There is a need to enhancing the intellectual resources of its best educators and use these educators to further educational training. At present what sort planning and effective training are required to be developed about Information and Communication Technologies to enable teachers to implement e-Learning as part of e-Education.
- 4) Setting up the choice of the architecture of the technology infrastructure that will support the implementation of e-Education in public schools in urban and rural communities of KwaZulu-Natal and what IT technology infrastructure are currently used and how well its equipment is maintained.
- 5) Finding out how public secondary schools use Information Technology as communication tools to create a network with others, within the school, in the local community, and expanding out to the global community at large.
- 6) At present what type of computer hardware and software teachers use at public secondary school in KwaZulu-Natal.
- 7) At present whether teachers have adequate materials to use Information Technology to support their personal and professional productivity through the administrative applications and communication with colleagues and students via e-mail and throughout classrooms.
- 8) At present how teachers integrate Information Technology throughout the secondary school's curriculum and whether they cope with the new skills as quickly as technology creates new challenges.
- 9) At present how are computers used to support teaching beyond drill and practice and for what purpose the computers are mainly used at schools.

- 10) The country's education system needs to establish a reliable and functional education management information system for the education thus; how do the principals understand the potential contribution of computer technology to learning.
- 11) The country's education system needs to establish a reliable and functional education management information system for the education thus; how the ministry of the Department of Education does understands the potential contribution of computer technology to learning

1.3 THE PURPOSE OF STUDY

The general purpose of this research is to create an optimal use of computers in public secondary schools in urban and rural communities of KwaZulu-Natal in delivering quality education by providing teachers the required tools. The researcher aims to show that the use of computers can contribute to the profession, society, institutions and schools, in order to provide a better quality of educational opportunities.

The contemporary age is regarded as the knowledge society. This is succinct recognition of the pervasive influence of computer technologies which have made knowledge the most prized commodity (Finland's EU president, 2006). The computer has been found useful in space exploration, engineering, banking, medicine, communication and commerce (Olalere, 2005). In addition to that, as Kmitta and Davis (2004) state, the computer has had a tremendous impact on the school social system. It has engendered a more constructivist approaches to teaching, improved overall learner motivation to learn, to stay and behave better in school, and it has radically changed teachers' professional development through constant update of their knowledge on the latest technologies, and the latest use of computers in

content areas. Also, computers have been useful as tools in ensuring a safe school environment, as improved communication is facilitated among parents, teachers, learners and administrators.

Dede (2008) affirms that digital technology will not only transform the intellectual activities of the school but will also change how the school is financed, organized, and governed. Technology could drive a convergence of higher education with IT-intensive activities such as publishing, telecommunications and entertainment, creating new methods of teaching and learning. It is therefore important that school strategies require the development of sufficient in-house expertise among departments and teachers to track technological trends and evaluate various courses of action; the benefit for experimentation; and the ability to form associations with other schools as well as with private sectors and governmental organizations.

New technology can be an appropriate vehicle for prompting meaningful, engaged learning. It allows students to work, on authentic meaningful and challenging problems, similar to tasks performed by professionals in various disciplines; to interact with data in ways that allow student-directed learning; to build knowledge collaboratively, and to interact with professionals in the field. Technologies can also be used to promote the development of higher order thinking skills and allow opportunities for teachers to act as facilitators or guides and often as a co-learner with the students (Schmidt *et al.*, 2004).

Technology as an administrative and management tool contributes significantly in directing and coaching learners in the use of Integrated Learning Systems (ILS), where entire course structures, lectures, practicals, assignment schedules and supplementary resources are held electronically and are available for student consultation whenever needed. The management of assessment schedules is just one small part of ILS, and an equivalent benefit is available through the use of other, less holistic tools (Baker, 1997)

Therefore the general purpose of the study can be restated as the following specific objectives:

- 1) To identify or determine the level of knowledge that is necessary to be able to use emerging and existing Information and Communication Technologies in e-Education.
- 2) To determine the types of network access teachers and learners have at public secondary schools in urban and rural communities of KwaZulu-Natal to access knowledge resources.
- 3) To discover what sort of training needs to be developed about Information and Communication Technologies to enable teachers to implement e-Learning as part of e-Education.
- 4) To find out what IT infrastructures are provided and how well teacher's equipment is maintained and used at public schools in urban and rural communities of KwaZulu-Natal.
- 5) To find out how the public secondary schools use Information Technology as communication tools to create a network with others, within the school, in the local community, and expanding out to the global community at large.
- 6) To determine what type of computer hardware and software teachers use at public secondary schools in KwaZulu-Natal.
- 7) To investigate whether teachers have adequate materials to use Information Technology to support their personal and professional productivity through the administrative applications and communication with colleagues and students via e-mail.
- 8) To determine whether teachers integrate Information Technology throughout the secondary school's curriculum and whether they cope with the new skills as quickly as technology creates new challenges.

- 9) To identify for what purpose computers are mainly used at schools.
- 10) To investigate how the principals understand the potential contribution of computer technology to learning.
- 11) To understand how the ministry of education understands the potential contribution of computer technology to learning.

Computer skills are significant for creative and innovative educational success. Computers are used daily in all types of working environments. For a better understand how technology affects the society, teachers need to realize the importance of technology and how it will impact the educational practices of schools around the globe. Teachers' performances can be enhanced when the improvement of teaching and learning objectives using technology is adopted as the norm (Shelly *et al.*, 2008).

Computers are used daily in all types of working environments. One of the common examples in education, most learners use computers for assignments, as well as typed and print it out notes for their study tools and teachers for their lesson plan. It is like all reports must be typed on a computer to get the full credit. The technical skills needed by teachers in the field of information systems seem to change even faster than ever before. Using the technology tools of the professional community adds significance and cultural value that will let teachers and learners make their suggestions, share and work together. In fact, technology provides a safe context for teachers to become learners again and to share their ideas about curriculum and methods (Shelly *et al.*, 2008).

Traditional education systems will face ever-increasing competition from the worldwide mass media, Information Technology in the home, and open learning alternatives (Gahala, 2001). Therefore, continuing developments in Information Technology (IT) are likely to lead

to fundamental change to all education sectors. In addition to this, substantial strategic planning at all levels is necessary to anticipate this, and to prepare the people involved for substantial change.

1.4 OVERVIEW OF THE RESEARCH DESIGN AND METHODOLOGY

This research is an empirical investigation using the quantitative approach for the results that will be reported. It involved a survey in a format of a structured-based questionnaire of a representative sample of teachers in urban and rural communities of KwaZulu-Natal. Data from the KZN Education Management Information Systems (EMIS) was utilized to ensure that the research targeted a representative sample size and population of respondents so that the results would be valid for all urban and rural communities of KwaZulu-Natal schools.

Prior permission was obtained from the Department of Education Regional Office to get access to public secondary schools of urban and rural communities of KZN. The research supervisor was requested to provide written permission, on behalf of the researcher, to conduct the research. Other requesting letters were also written to principals of schools as well as to individual respondents to answer the questionnaire willingly.

1.4.1 Research Methodology

Teachers from public secondary schools both in urban and rural communities of KZN were selected, using the purposive sampling method. Purposive sampling method as stated by Patton (2001) is a non random method of sampling where the researcher chooses information-rich cases from which one can learn a great deal about the issues of central importance to the goal of the researcher. The reason that purposeful sampling is supported to include trustworthiness to the

sample when prospective purposeful sample is larger than one can handle. It is used to obtain rich information that produces the phenomenon intensely, yet not extremely, like schools set up with extremely poor IT infrastructure were ignored as they did not meet the basic requirements of IT. Lastly, only teachers that are involved in public secondary schools in urban and rural communities of KwaZulu-Natal were considered. This aimed to ensure that all teachers get an equal footing in utilising appropriate and information-rich electronic learning materials.

1.4.2 Data Collection

The researcher collected data using 300 questionnaires distributed to a selected group of public secondary school teachers from at least 30 different public secondary schools, aimed to represent the entire population in great diversification throughout the aforementioned educational dimensions.

The data that was collected for this study was primarily quantitative in nature. Quantitative research is research involving the use of structured questions where the response options have been predetermined and a large number of respondents are involved. Therefore, the data was collected through the use of questionnaires and some practical observations were done to see how teachers completed their work in appropriate way.

Data collection for a case study relies on many sources of evidence including documentation, archival material, questionnaires, direct observation, participant observation, Google's search facilities (Google Alert, Scholar Google, Google Suggest, and Google Print) and a library's electronic database records such as NEXUS and SABINET searches, to identify books in print for inter-lending from the libraries of other South Africa institutions of higher education.

1.4.3 Data Analysis

After collecting data from respondents, the accuracy of captured data was verified and analysed using the analytical programs SPSS 15 and MS Excel Office 2007 applications.

1.5 INTERIM RESEARCH QUESTIONS

Much of the literature review noted that technology is used for a variety of applications in education. This can be rephrased as the following research questions:

- 1) What are the levels of knowledge that teachers need to have to be able to use emerging and existing Information and Communication Technologies in e-Education?
- 2) What types of network access do teachers and learners have at public secondary schools in urban and rural communities of KwaZulu-Natal to access knowledge resources?
- 3) What sort of training needs to be developed about Information and Communication Technologies to enable teachers to implement e-Learning as part of e-Education?
- 4) What IT infrastructure is provided and how well is its equipment maintained and used at public schools in urban and rural communities of KwaZulu-Natal?
- 5) How do the public secondary schools use Information Technology as communication tools to create a network with others, within the school, in the local community, and expanding out to the global community at large?
- 6) How dependent are teachers on computer hardware and software provided to them by the schools?

- 7) Do teachers have adequate materials to use Information Technology to support their personal and professional productivity through the administrative applications and communication with colleagues and students via e-mail and throughout the classroom?
- 8) How do teachers integrate Information Technology throughout the secondary school's curriculum and do they cope with the new skills as quickly as technology creates new challenges?
- 9) For what purpose are the computers mainly used at schools?
- 10) Do the principals understand the potential contribution of computer technology to learning?
- 11) Does the ministry of education understand the potential contribution of computer technology to learning?

1.6 LIMITATIONS OF THE STUDY

This study essentially investigated the effective use of the computer and emerging technologies for e-Education in public secondary schools in the urban and rural community of KwaZulu-Natal. Three main limitations of this study were identified. These limitations are mentioned as follows:

- 1) Even though the sample size of the area was satisfactory, it would be much better if it could be increased by more respondents. But due to the time constraint and teachers were busy; it did not happen as researcher's wanted. In addition to that, because the research focused on teachers, the respondents in this study were teachers only whereas, learners were not included. If the survey encompasses teachers as well as learners it would be much better to draw generalized outcomes for all KZN schools.

- 2) Questions in the survey were not intended to be exhaustive. They have been tailored to examine the areas of need.
- 3) The sample includes 300 teachers of public high schools out of which 100 were given to practical assessment. Teaching could not be disrupted at certain times. Therefore the sample size was limited and it was impossible to select respondents based on different abilities as intended.

1.7 OVERVIEW OF DISSERTATION CHAPTERS

Following this introductory chapter, the dissertation is divided into five major chapters. In the next chapter (Chapter Two – Literature Review) a critique of existing literature relating to the effective use of computers and emerging technologies is presented. It discusses theories, practical problems and previous research as sources to check what research has already been done and what still needs to be done.

In chapter three (Recent research focusing on e-Education in Public Schools in KwaZulu-Natal) the researcher reports on recent research focusing on e-Education and teachers' willingness to adopt this form of education delivery.

In chapter four (Research Design and Methodology) the scientific bases for the research which has been conducted are provided as well as issues such as data collection methods, data analysis methods, sample population and size. This chapter deals with different facets of designing questionnaires to investigate a research hypothesis, so that data will be collected from the objectives of enquiry in order to solve the problem concerned. Therefore, the entire instrument used in the research project is discussed in this chapter.

Chapter five (Findings and Analysis) presents the results of the tests conducted for the study. Different tables and various graphs are used to illustrate and emphasize the main findings and the interpreta-

tion of the results. It uses an appropriate statistical procedure of comparing, correlating and covariance to analyse the data eventually obtained from the appropriate research design.

The sixth and last chapter of the research (Conclusion of Findings of the Research and Discussions) explains the final recommendations and conclusion of the results obtained in chapter five for future and further study. Besides, it conveys the plan in terms of which the proposed research will be carried out.

1.8 CONCLUSION

This research is designed to help in providing learners and teachers in public secondary schools in urban and rural communities of KwaZulu-Natal with effective information they need in using computers and other emerging technologies in their education. It seems that increasingly computers and technology hardware are being used in an educational setting. This trend of connection of schools to the system, using long distance learning, and reliance on the internet for information, is seemingly being promoted without any real test or study based on the usefulness of such technology in education. The uncontrolled use of technology without examining its long-term benefits and potential problems is not something that should be allowed to happen in education without prudent study.

Given these factors the public secondary schools may need to revisit their computer policy statements. Therefore, this proposal aims to give educational decision makers and computer coordinators, students and mainly teachers a framework for the development of an advanced way of exchanging ideas, information and educational-based computer technologies.

The next chapter presents the literature review. This chapter aims to provide readers with the background information that was

used to conduct the study. A vast survey of literature reviewed will deal with how the literature survey was conducted, factors that influence the effective use of computers, and the benefits of using computers in education at large and in public secondary schools in KwaZulu-Natal in particular.

Chapter 2

LITERATURE SURVEY

2.1 INTRODUCTION

There are many reasons why public high schools should be implementing and integrating Information Technologies (IT). There are pressures from society, and specifically the world of work, and from the changing emphasis and goal of the new South African curriculum. The South African Department of Education places emphasis on life, mathematical, computer literacy skills and school subjects are also to be changed to foster the skills needed for a democratic society and globalized world (curriculum, 2005). There are also school level pressures that can be eased or removed by means of IT. Teachers learn how to use a computer as one of the most important tools for investigating, looking for information, and for good managing systems.

In recent years computers have been slowly expanding into learning systems, firstly at tertiary level, then at secondary level and lastly at elementary level (Stearman, 2000). By the end of the last century computers were extensively used, extensively researched and entirely incorporated into the workforce as an individual tool. In the last quarter century nearly all aspects of people's lives were impacted; particularly shopping, business and communications (Finland's EU president, 2006). Because of the prominence of computers in society, it is important to understand what a computer is, and how a computer is useful. Yet despite all the excitement over the technology it has not been well integrated into the education system, in particular it has not impacted "the way we learn".

The use of computers in education has rapidly changed the way that people learn in a short period of time. Barrett (1996) explains that in the past, most computers were placed in a computer room where learners were sent for self-paced tutorials. However, Williams (2002) affirms that this is not education and that technology should support the multifaceted private and social activities that make up the learning process. With this in mind, as stated by Penfield and Larson (1996) MIT (Massachusetts Institute of Technology) created a fully distributed computing environment to support learners through the provision of e-mail, access to software, personal file storage and other communications utilities. In this way computers were used to aid learners in the learning process.

Educational technology has been put forward as an attempt to address the problem statements of integration with teaching and training methods. The applications and programs that have been designed for computers are meant to teach the learners certain aspects of a course that help them explore and explain their knowledge, and sometimes the courses are even conducted purely on computers (Parusnath, 2002). Recent studies have shown the successful implementation of educational technologies depends largely on the skills and attitudes of teachers, who eventually determine how they are used in the classroom. Bullock (2004) found that teachers' skills and attitude are major enabling/ disabling factor in the adoption of technology.

Hodorowicz (2000) states that computers and technology have enhanced the educational process in many ways. The major benefit of technology is the easy and fast access that has come from networked computers such as Internet. With Internet, any subject matter, research papers, and technical documents are available to anyone and from anywhere. Bengu (1996) notes that the move to on-line education via the Internet is likely to substantially reduce the cost of education for most institutions, thus creating new learning opportunities for

students throughout the world will change the nature of teaching, learning and software development.

Information communication has become much easier and simpler through the use of the technologies. Computers are also a huge benefit in terms of research. Research that was not possible just a few years ago recently has been made a reality by innovations in computing. These include areas such as high performance computing, database processing, and data acquisition and analysis (Hodorowicz, 2000).

2.2 HOW THE LITERATURE SURVEY WAS CONDUCTED

This research depended on the electronic resources provided by the University of KwaZulu-Natal library's electronic database records such as NEXUS, EBISCO-HOST and SABNET searches, to identify books and journals for inter-lending from libraries of other South Africa institutions of higher education. These are used to conduct the literature survey, in order to establish a theoretical framework and to determine the appropriate research methodology to gather data for empirical analysis. This also helped to eliminate some of the initial research problems that have been solved by other researchers.

The researcher also used many search engines such as Google, Google Scholar, Yahoo, Ask, and AltaVista to gather data and define some key words and terminologies.

2.3 THE ROLE OF THE CONCEPT MATRIX IN THE LITERATURE SURVEY

The researcher constructed a concept matrix, given under Addendum 6 to present a bird's eye perspective of the references used in this and the previous chapter. The researcher determined the significance of literature in relation to the search project by assessing the ab-

stracts and conclusions of references, based on the search terms that were used for each of the aforementioned database searches. Every reference that appears on the concept matrix has been incorporated in the bibliography of the thesis. Furthermore, the researcher includes the references that are found in subsequent chapters (chapter 3 and 4), other than those used in the literature survey.

2.4 FACTORS THAT INFLUENCE THE USE OF COMPUTERS IN EDUCATION

A research report commissioned by the Microsoft Corporation (2004) and conducted by Forrester Research stated that factors that influence the use of computers are: household income, education, employment status, age, gender, family size, and attitudes toward technology. These factors are all important determinants of computer use among working-age adults. The relationships between household income, education, and age and the use of computers among working-age adults are important to consider because they often indirectly contribute to lower rates of computer use among individuals. Working-age adults with lower levels of education and household income are less likely expected to use computers at both home and work than are those with higher levels of education and household income. It is significant to consider the relationship between computer use and levels of education and household income in order to understand how these factors influence computer use. A computer user's experiences and attitudes about technology are also important determinants of who uses accessible technology.

Fraye (2002) states the following possibilities that influence the use of computer in education:

- 1) Learners can actively engage in learning to use technological tools that lead to greater time management and greater depth

of knowledge and of course that can emphasize continuous improvement of a piece of work.

- 2) Learners can work more collaboratively with teachers and parents.
- 3) Teachers can handle more practice with feedback and can examine their existing conceptions and update or modify.
- 4) Learning materials can be provided easily to match the learning style of a learner.
- 5) Self-paced learning may be possible, each student may learn according to his/ her cognitive ability.
- 6) No time restrictions: classroom dialogue can extend beyond the time and space constraints of class time.
- 7) Schools can restructure their role, using individual and peer-group work or technology for some purposes, thereby freeing time to make their unique contribution to advanced methods of student learning.

Teachers and learners can use computer-based tools that raise high expectations when introduced in learning facilities, such as text or graphic editors, databases, spreadsheets or presentation packages, to help in processing information and individualized interactivity. Two important benefits that come to mind are: a) Teachers can enrich their presentations at school with rich graphics and tables, which can be stored easily in their computer, updated, and readily accessible for presentation to the whole class by means of a projection device such as an overhead projector, data projector or interactive whiteboard; b) Learners' papers may be of higher quality, especially if, instead of just assigning a grade, the teachers request that each paper be typed using a document software and delivered on portable and removable storages or through electronic mail, thereby allowing the teacher to interact with learners by inserting comments and suggestions and give it

back to the learner for updating until a satisfactory paper has been achieved (Osin, 1998).

According to Dwyer, *et al.* (1991) computer-based technology can change the way teaching occurs including:

- 1) Great expectation from the teacher's side, that is a move from the teacher as the dispenser of knowledge to the teacher as facilitator or coach.
- 2) Teachers expect more of learners and present more complex material.
- 3) Can more effectively meet the need of individual.
- 4) Spend less time lecturing to the whole class and becoming more open to many perspectives on a problem.
- 5) Becoming more comfortable with small-group activities.
- 6) Team teaching.
- 7) Interdisciplinary project-based instruction, and (8) altering the master schedule. Dwyer, *et al.* (1991) indicate that these changes took place in five phases: entry, adoption, adaptation, appropriation and invention.

A survey carried out at Western Michigan University in 1995 by Spottes and Bowman (1995) lends credibility to Geoghegan's ideas. Factors identified by more than half of the respondents as important in influencing the use of instructional technology were: availability and access of equipment, need for technologically oriented students' learning environment, finance to purchase materials, interoperability and compatibility with computers, advantages over traditional methods, increased learner interest, ease of use, information on materials in their discipline, compatibility with existing course materials, university training in technology use, time to learn the technology and comfort level with technology.

The physical network allows learners and teachers to work together, whether for mutual consultation and suggestion or support and encouragement. Hence the new technologies alter the means and modes of studying. Learners can link to other learners, across boundaries and across continents. Schools can reduce office equipment costs, printers and servers can be shared with multiple users. A physical network can take part in the development of learning material within teachers and learners in other classrooms or countries. Teachers in the remotest place can be encouraged to take part in important professional development projects. Indeed the whole education system can work like a backbone to the body system (Hinds & Kiesler, 2002).

2.5 THE BENEFITS OF USING COMPUTERS IN EDUCATION

For some tasks, computers can provide distinct advantages over more traditional approaches. As Beare (2007) states when he talks about computer as a language learning tool, the use of the computer is not only restricted for listening to the language, but also provides visual inputs and outputs to students with more contextual clues. Students interacting with computer media are also using more advanced skills, as learners become more familiar with technology which can have a strong reinforcing effect on the learning environment by connecting physical actions (clicking, dragging, hovering and typing) with desired results. Students more comfortable with computers are allowed more control over their own learning process, where they can do the task as they manage to repeat their own exercises and sequences based on their own progress.

Again Beare (2007) affirms that with the aid of Internet and self-pacing tutorials using CD/DVD-ROM based materials, teachers can quickly exchange and retrieve data, thereby addressing an individual learner's needs. This is especially effective when teaching languages for special purposes such as business related languages. An example

would be white papers displayed on a company website addressing certain technologies in language that students are currently interested in. Using media related devices; the teacher can often provide distinct content addressing specific student needs, thereby improving efficiency and effectiveness.

The use of fully automated computer systems can assist schools in solving tasks that are at the moment performed manually, e.g. for teaching, record-keeping and storing as a key component of administrative management. Using computer technology can also improve the quality of management educational environments. For instance, to meet the needs of teachers and learners, course organizers and external examiners. The scoring method tools in test and examinations can be improved by using electronic record keeping technologies. The manual capture of marks is prone to error and furthermore, time consuming, as well as costly to check. However, through the use of automated data capture devices such as an Optical Mark Reader (OMR) not only the quality of management but also the scope of the presentation content can be improved. The management of the assessment helps in all aspects for a fully automated system to interact with learners and teachers (Mogey & Watt, 1999).

Stein (1999) emphasizes that the benefits, costs and strategies for dealing with the use of computers and how the resource enhances the computer affects instantaneity, precision, documentation and workforce preparation. She says a technology resource enhances the function of the learner teams. Notebook computers, client-server technology, network residence halls, computer laboratories, computerized classrooms, and high speed connections whenever implemented in schools and colleges, create opportunities for new and effective forms of teamwork.

Technologies, especially communication systems, have altered the way teachers and learners interact. With e-mail, chatrooms and

listserv technology that are worldwide e-mail-based disciplines, one can join freely, share ideas and discuss specific topics that are known as shared threads that can give another user what they can access from one another. They can improve their planning process digitally, linking to the instructor without having to enquire about office hours, without going physically to campuses' library and classmates' residence. If a suitable infrastructure is implemented, learners can present, submit, or distribute their assignments electronically, without consuming costs and time for printing (Stein, 1999).

There are numbers of benefits of using computers in education. The increasing uses of web-based learning tools provide integrated environments of various technologies to support teachers, and learners needs via the Internet. The uses of online technologies such as e-mail, chat rooms, bulletin boards, and instant messaging have increased at an unbelievable rate. America online is said to carry over 13 million e-mail messages daily (Jeffery, 2003). With e-mail, chatroom, and LIST-SERV technology, teachers and learners can discuss problems online.

2.5.1 Electronic Mail (e-mail)

E-mail is used to exchange messages or other information with one another via the Internet. It is a highly effective medium of communication for school entities and personal use. It offers a much richer form of communication and a rich source of information integrated with audio, video, and even animations with text and graphics. E-mail, instead of being delivered by the postal service to a postal address, it is delivered by Internet software through a computer network to a computer address (Ivala, 2000).

E-mail is a channel of information that can be exchanged as sharing data or information (Long & Long, 2000). One use of Internet that almost every business requires in order to improve productivity is electronic mail. It is not only a faster method but also a more secure

method of sending information almost in an instant. E-mail allows individuals to communicate and exchange files quickly and cheaply with other Internet users.

The main advantages of electronic mail as described by McCarthy (2003), is that they are normally much cheaper than using the telephone and much faster than sending through the post office. Many different types of data can be transmitted, such as images, documents and speech. It basically reduces cost for paper and the need for work to be typed, edited and then printed. In other words, it is much faster and better than the postal service. It is relatively simple to send to groups of people such as learners, teachers, colleagues and principals of the school.

The disadvantage of e-mail is, if some people do not have high-speed computers, sending them an e-mail that is full of large graphics would not be effective (Morley & Parker, 2007). Furthermore, a document sent by the e-mail can undergo through the scanning system but conversions of files are not provided. If a user does not have software pre-installed to his computer that support the format type of the attached document; he/she will be unable to view the document. For instance, if someone sent a document in adobe format, there must be adobe installed to the recipient computer to view the file sent through attachment. Thus, e-mail does not include conversion format files.

2.5.2 Bulletin Board

Many bulletin boards can be accessed through the Internet. Two common public bulletin boards on the Internet are USENET and LISTSERV. USENET, a world-wide disseminated discussion and collection of thousands of hierarchically classified and organized newsgroups that include articles, messages and post. It is available on a wide variety of computer systems. LISTSERV is an electronic mailing list that enables a large number of groups to communicate effectively

with one another without any requirement of maintaining a mailing list of all other groups of participants. It is utilized for e-mail driven discussions for highly customized set-ups to suit the individual user of a mailing list. USENET and LISTSERV are examples of a bulletin board that can and are of benefit to schools in general and can be said to offer a boost to distance learning. In general a bulletin board can post useful links such as handout materials, policies, or the syllabus between learners and teachers at school (Ivala, 2000).

2.5.3 Newsgroups

Using newsgroups is similar to discussion group. Teachers post new messages to groups of learners, or reply to a particular learner, or vice versa. In fact, if they reply to an individual learner, an e-mail message will be sent directly to that learner instead of to the group of learners. To do so, however, learners have to know other learners' or teachers' e-mail addresses. They can attach images and documents just as they would in e-mail (Ivala, 2000).

2.5.4 World-Wide Web (WWW) and Internet

As Deitel *et al.* (2001) state, the Internet and World-Wide Web (WWW) are listed among the most important and profound tools of e-Learning. In the past, most computer applications at schools were installed on stand-alone computers that were not connected to one another, whereas today, unlike past applications, it can be written to communicate among the global telecommunications network of linked computers that form a gigantic repository of stored information. The internet mixes computing and communications technologies together. It makes information conveniently and instantly accessible throughout the world. It makes work possible for individuals and small businesses to get world wide exposure. It is a truly revolutionary technology.

The World-Wide Web is an exciting and innovative front-end to the Internet. Officially WWW is described as a “.....wide area hypermedia information retrieval initiative aiming to give universal access to a large universe of documents” (McDermott, 2007). The WWW provides internet users with a reliable and convenient means of accessing a variety of information resources that support pictures, text, data, sound, and video on the Internet. Among many popular browsers that facilitate navigation of the WWW are Mozilla Firefox, Netscape Navigator, and Internet Explorer.

The potential benefits of the computer in education are plenty. The World-Wide Web has the capacity to allow communication all around the globe. It provides teachers and learners with the opportunity to observe and learn from other cultures and other people. This communication comes at low cost to schools and parents, and offers a greater learning experience than books can offer (Matthew & Dohery-Poirier, 2000).

In America most teenagers say that the Internet’s ability to help them with their schoolwork and to help them learn new things is one of its best features. This potential role as educational tool is often the main reason why a family gets Internet access. Research done by Pew Internet and the American Life Project and conducted by Lenhart (2001) provides statistics that more than three quarters of online teens (78%) say the Internet helps them do their daily schoolwork, while 47% say it helps them a lot. 87% of parents also agree with their online children that the Internet helps learners with learning tools. In fact 93% of parents consider that the Internet supported their children to learn new things. Therefore there can quite well be optimism in advancing the Internet as a means of education.

From a teacher's perspective, the WWW can help with many daily management tasks by reducing the paper flow required for paper-based instruction, allowing for quick and easy revisions to instruc-

tional materials, and ensuring that instructional materials are always available to students. In addition, because the bulk of instruction is delivered via the Web, the teacher is free to spend time working with individual students and small groups; less time is thus spent on whole-class instruction (Matthew & Dohery-Poirier, 2000).

2.5.5 Distance Education (e-Education)

Schools that specialize in distance education are learning how to use multi-media courseware and the Internet effectively. Distance education can be provided in different ways to meet learners' needs. In the near future they will have a choice between attending passive lectures at a convenient time and anywhere completing interactive multimedia tutorials in a distance-based curriculum. Distance learners will no longer have to be so isolated (Macdonald, 2002).

The computer has been used in a variety of ways in instructional processes and in administration. In the instructional process, through computer assisted instruction, integrating systems and collaborative networked technologies, among others, computer information and messages are presented to learners through an interactive process involving drill, tutorials, dialogue, computer hands-on practices, simulation, and software that provides individual teach yourself tutorial. Computer-presented materials on problem situation to students, guide their thinking, respond to their questions, and manage their performance. That is, the computer is used to instruct so as to achieve the desired level of proficiency (Jenkin & Springer, 2002).

2.5.5.1 Computer-Based Education

As Matthew and Dohery-Poirier (2000) point out, Computer-Based Education evolved from many Web-based instructional methods such as often referred to as Computer-Assisted Instruction

(CAI), Computer-aided Instruction (CAI), Computer-Managed Instruction (CMI), Internet-Based Instruction (IBI), or Web-Based Instruction (WBI), but collectively known as Computer-Based Education (CBE).

McNutt (1996) says that there are several terms used to describe the use of computers for the purpose of instruction and learning. These include TBT (Technology-Based Training), CAL (Computer Aided Learning), CAI (Computer Assisted Instruction), CBL (Computer-Based Learning), CBI (Computer-Based Instruction) or CBT (Computer-Based Training). McNutt (1996) also says the use of the terms CAL, CBT and TBT are used interchangeably by authors of Computer-Aided Education.

Computer-Aided Learning (CAL) is being developed in order to provide support to learners in a wide range of subjects according to their types of studies. For instance, Geo Tech CAL stands for Geotechnical Engineering, CALM for Computer-Aided Learning in Mathematics, CAL Met for Computer-Aided Learning of Meteorology, CALT for Computer-Assisted Language Terms and so on (Greenhalgh, 2001).

The use of the World-Wide Web as an instructional tool is really valuable. Web-Based Instruction (WBI) can offer learners something like a “virtual teacher”, because learners can access the instructional materials anytime, anywhere; even though they were physically absent from school (Basaza, 2006). From a teacher's perspective, WBI can help with many daily office automated work by reducing the paper flow required for paper-based instruction, as well as allowing for quick and easy interactivity with learners. WBI can be used to meet the needs of a more diverse student group. Distinctive classes consist of students with varying abilities and previous knowledge, and WBI can help a teacher to address not only these differences but also allow learners to work more progressively and is more comfortable – because some learners may need to work faster than their peers while others may wish to take longer. In addition to that the use of WBI pro-

vides the opportunity for numerous grade levels to be accommodated in the same classroom concurrently (Matthew & Dohery-Poirier, 2000).

Many businesses and organizations have recognised the need for more cost-effective methods of training. Similarly, teachers now have to address the economic cost-effective methods in improving the educational issues such as curriculum, administration and teaching. In addition to that even though CBT prompted the provision of greater access to education by the delivery of education and training, McNutt (1996) affirms that while having many advantages, CBT systems are not found to be logical and rational. A machine, even the most expert machine in the world, cannot generate the human relationship between students and teachers. In addition to that CBT systems are expensive and need some platforms and peripherals for running, and these facilities are expensive too.

2.5.5.2 e-Learning

e-Learning offers new tool sets and new channels for delivering a flexible and reliable distance learning environment in the business sector, tools for performance assessment, items for online constructive training and performance support, and channels for online learning and training, that will ensure the meaningfulness of distributed learning and corporate knowledge management (Hartley & Worthington-Smith, 2003).

While a substantial amount of learning takes place in schools, these are not the only places in which people want to be educated. There is also a demand for e-Learning that facilitate learning in places and times where learning does not normally happen. The increased willingness of educational organizations to use Internet technology to deliver education facilities, and the ever-greater number of people with

networked computers in their homes, are providing many people with new opportunities for teaching (Basaza, 2006).

The problem with the traditional classroom-based approach (Hartley & Worthington-Smith, 2003) that it is often unidirectional, relying on passive learning through which a teacher or instructor conveys knowledge to an approachable audience. Educational aids and techniques can make it more interactive and practical, but used alone, it is difficult and expensive to make the traditional approach a versatile learning experience. However, e-Learning empowers learners to be in charge of their own destiny and leaves them with greater freedom, enabling them to study in their own time, at their own pace and wherever they want. It is a growing and dynamic environment which quickly evolved to include enhanced electronic elements for teaching. There are many other advantages to e-Learning in both education and corporate training.

After dealing with the students and future use of technology, Basaza (2006) says e-learning is not only reserved for students who use technology to learn, whereas teachers also constantly use computers and the Internet to update their technology literacy framework. For example, he says many teachers surf a website such as <www.schoolkit.com> to access new learning resources for use in their classes or to bring their skills up-to-date.

2.5.5.3 e-Library

Academic libraries and e-Learning in higher education are providing valuable information. McLean (2003) notes that students and teachers are using computerized library systems to locate information systems outside the library sphere. McNutt (1996) also states that many first world countries typically transformed into the Online Public Access Catalogue (OPAC), searching rather than using the old cataloging system; so that everyone could benefit from enriched services of

the library by not limiting them to a single area of the library's physical boundary.

The research done by the Pew International and American Life Project (Lenhart, *et al.*, 2001) shows that teenagers use the Internet for doing research on significant projects and that the internet increasingly has a place inside the classroom. Of these 94% of youths use the internet for school work, 71% for their most recent information, 41% for e-mail and instant messaging, 34% for downloading online study aids and 17% for creating a Web page for a school project, and others use e-Library as an essential study aid outside the classroom.

In today's world one does not have to be physically locked in one single place and conditioned by time limits. In fact, one fifteen year old boy who answered a question posed by the research firm Greenfield Online for the Pew Internet Project about the benefits of e-Library gave the following statement: "Without Internet you need to go to a library and walk around looking for books. In today's world you can just go home and get into the Internet and type in your search term. The result is endless. There is so much information that you have to ignore a lot of it." Lenhart *et al.* (2001) continues this explanation and says: "I find the Internet most useful as online study aid when I need help for the school."

2.5.6 Network Benefit of Data Sharing

Networking technologies provide a data link layer function, thus they allow a reliable connection between one computer and another on the same network. The Internet is a set of interlinked networks. It links millions of networks, large and small, government and private, commercial and academic, throughout the world (Capron & Johnson, 2002).

Originally, before the introduction of Personal Computers (PC), hardware for the mainframe computer was kept in its own place. Anyone looking for computer access had to go to where the computers are located. However, today most large computers are decentralized. That is, the computer itself and some storage device may be in one place, but the devices to access the computer terminal or even other computers are disseminated among users. These devices are usually connected to the computer by telephone lines (Capron & Johnson, 2002).

Data communication (also called telecommunications) is the electronic collection and distribution of information from and to remote facilities. Data communications hardware is used to transmit digital information between terminals and computers or between computers. These hardware components include the modem, the network interface card (NIC), the front-end processor, the multiplexer and the router (Christopher, 2006).

There are plenty of hardware devices that provide better and faster performance for a network. However, all the hardware does not have the same capacity. It depends on their manufacturers' quality and good material. Nowadays computer hardware is depending on shapes, sizes, colours and speed; whether they are large or small, black or white, light or heavy, fast or slow. For instance, computer keyboards seem to come in all shapes and sizes and even wireless. Keyboards have come a long way and will get better still in time. Perhaps someday the need for keyboards will be lost and other devices for inputting data will be developed (Capron & Johnson, 2002).

There are quite a number of benefits that can be obtained from several-linked computers in education, like some of the ideas noted by Mitchell (1999):

- 1) File sharing - Network file sharing between computers gives one more easy facilities than using removable storages such

as diskettes, Zip drives, USB flash drives, CDs and DVDs. Not only can one share photos, music files, and documents, one can also use an office network to save copies of all of your important data on a different computer.

- 2) Printer / peripheral sharing - Once an office network has been set up, it is easy to set up all of the computers to share a single printer. No longer do teachers have to bounce from one system or another just to print out an e-mail message or educational handouts. Other computer peripherals and equipment can be shared similarly such as network scanners, webcams, and CD burners.
- 3) Internet connection sharing - Using an office network, multiple teachers' staff members can access the Internet simultaneously without having to pay an ISP (Internet Service Provider) for multiple accounts. Therefore, the staff members are able to share information and get in touch more easily.
- 4) Internet telephone service – So called Voice-over IP (VoIP) services allows one to make and receive phone calls through an office network across the Internet, thus saving money.

The importance of a networked computer is highly rated, not only in education but also in every part of business. Some of the many benefits that can be obtained from the effective use of linked computers in education are research matters and exchanging of information whether it is an academic or non academic.

2.6 LIMITATIONS OF USING COMPUTERS IN EDUCATION

Computer networks are costly to implement and develop. Although individual computers are relatively low-priced and the computer hardware and software market is very competitive, it is still ex-

pensive to develop instructional networks and purchase the system software to run them (Willis, 2003).

As Richard and Brent (2001) affirm, technology will never be able to do something that first-rate teachers do routinely, such as advising, encouraging, motivating and surveying as role models for students, helping them develop the communication and interpersonal skills they will need to succeed in their careers, and getting them to teach and learn from one another.

The technology is changing quickly. Computer technology evolves so fast that the remote computer user teachers focused solely on innovation and “not meeting tangible needs” will constantly change equipment in an effort to keep pace with the “latest” technical advancements (Willis, 2003). Since technology is always changing and updating, this means that new technologies mature quickly and soon become obsolete, even before they have been mainstreamed.

Widespread computer illiteracy still exists. While computers have been widely used since the 1990's, there are many who do not have access to computers or computer networks. Willis (2003) believes learners must be highly motivated and proficient in computer operation before they can successfully function in a computer-based distance learning environment. The government of Ghana orders that all top officials of the civil service, including chief directors, directors and heads of departments, should be computer literate by the end of 2005 (Glover-Quartey, 2004). In 2005 the ministry of education in South Africa has introduced a compulsory in-depth teachers training skill that will carry on to the next three years (DoE, 2005).

As Criss (2004) states the disadvantage of having computers in the classroom, is that most of the technologies depend on electricity. If the power goes down the lesson would have to be postponed and re-scheduled. Another issue concerning computer use in classrooms is

that a lot of teachers have not been trained to use a computer efficiently, and many do not even know the basics. An enormous amount of time would have to be consumed for the teachers to learn both the hardware and the software of the computer. Teachers also would need time to collaborate with other teachers. It is not that easy to get time as many teachers spend their free time in planning lessons and the weekly events of their classroom. In addition to that it is hard to get the students' attention when they are working on the computers. Students are then in their own little world, and they do not talk to their classmates (Criss, 2004).

Even though there has been a strong push to get educational technology into the hands of teachers and learners, Gahala (2001) argues that there are many obstacles to implementation that still exist. Equipment may not be placed in an easily accessible location. Hardware and software often pose problems for teachers in the classroom, and just-in-time technical support may be unavailable. Teachers may lack the time and the motivation to learn technology skills. Professional development activities may not provide ongoing, hands-on training for teachers or practical strategies for implementing technology into lesson plans. Initial technology funding may not be sustained and thus not be capable of providing upgrades, maintenance, and ongoing professional development. Fortunately, these obstacles can be addressed and overcome. This critical issue provides practical information for promoting technology usage in schools.

The increasing use of computers to aid education has resulted in notable changes to traditional teaching methods. The use of computerized language has become one of the literacy basics and students now learn to use the computer to retrieve information, to be familiar with data processing and to get used to logical thinking. Even basic subjects such as mathematics, history and social studies are being taught with the aid of computers. There is no doubt that computers

are a valuable and useful tool; however, they are only one part of the educational process and often optimum benefits will come from finding an ideal balance between new approaches and more traditional methods (Rosenberg, 2004).

2.7 IMPLICATIONS FOR TEACHERS TO USE TECHNOLOGY

The Centre for Applied Research in Education Technology (CARET) provides a review, done by Cradler *et al.* (2002) of the research findings and implications related to preparing teachers to effectively integrate technology into the curriculum and instruction. Its surveys consistently show that teachers are interested in technology, but require improved opportunities to develop their capacities. In fact, according to the results and findings of the CARET, only 20% of teachers considered themselves well prepared to use technology in their classes.

A report from the National Centre for Education Statistics (2000) asserts that 66% of teachers who received more than 32 hours of technology related training felt well to very well prepared to use technology in their classrooms. The percentage that were well to very well prepared to use technology dropped to 34% for those who receive from 9 to 32 hours and to 24% for those who received less than 9 hours of technology- related professional development (NCES, 2000).

A careful review of studies conducted by Cradler *et al.* (2002) on the effective use of technology in the United States indicates that technology is applied most critically to teachers. The extent to which teachers are prepared to infuse technology into curricula and instruction is a major contextual factor. In fact, the International Society for Technology in Education (ISTE, 2000) asserts some critical ideas in supporting of the studies conducted by Cradler *et al.* (2002) by saying: “Schools of Education can model best practices for new teachers by

preparing their faculty to infuse technology throughout the curriculum. In addition courses in teaching methods can incorporate content from general education courses to promote technology infusion across the curriculum. Schools of different departments can incorporate technology to model teaching with technology in content areas” (ISTE, 2000).

The education faculty should integrate technology applications into preservice teacher assignments and field activities so that new teachers have opportunities to acquire technical skills and practice instructional strategies. In fact, as portrayed by Cradler *et al.* (2002), some studies reported similar trends in the effectiveness of strategies for increasing teacher confidence and motivation to use technology. Use of technology standards in the classroom is supported when teachers are provided with information and professional development on how to analyse and select electronic learning resources that align with and support state and national instructional content standards. Preservice and practicing teachers and education faculty benefit from observing and working with mentors who are experienced using technology with standards-based curricula (Abbott & Faris, 2000).

According to Usun (2004), many factors affect the use of computer and communication technology in schools, e.g. educational goals, nature of the subject, projects, communication and connection to other subjects, access to computers and software. Increased computer access and quicker Internet connections have put pressure on schools to increase the use of ICT in teaching. Teachers’ attitudes toward ICT influence their behavior. Teachers must evaluate and make choices regarding the available ICT resources and the extent to which they are willing to invest in increasing the use of ICT.

Discussions, debates and interaction between learners and the teacher and learners are an important part of the learning process. Teachers are faced with the challenge of increasing and enhancing the

communicative interchange, both in the school-based environment and distance or distributed learning contexts. Teachers who wish to use ICT to promote the communicative aspect of their teaching must thoroughly acquaint themselves with the technology and ideas for its use, which can be unfamiliar and challenging. It must be remembered that learners are also unlikely to feel at ease in a new educational setting (Usun, 2004).

Although they may be adept at computer games and using their thumb on mobile phones, they may not be as prepared for the systematic and powerful use of ICT in their studies. Both teachers and students need time to become familiar with the new opportunities ICT offers.

2.8 EMERGING TECHNOLOGIES

In order to understand emerging technology in education, it is helpful to consider the purposes to which technology is applied. One distinction that is particularly helpful comes from Reeves (1999), who describes learning “from” computers as different than learning “with” computers. When students are learning “from” computers, the computers are essentially tutors. In this capacity, the technology primarily serves the goal of increasing students’ basic skills and knowledge. In learning “with,” by contrast, students use technology as a tool that can be applied to a variety of goals in the learning process, rather than serving simply as an instructional delivery system. Students use the technology as a resource to help develop higher order thinking, creativity and research skills.

The term “technology” can be used to mean a very wide variety of things, from computers to other devices. In this research, the term is used to refer broadly to computer-based tools — hardware and software, the Internet, and computer-based multimedia. Generally, more advanced technology is involved in learning “with” technology. It in-

volves students using technology to gather, organize and analyse information, and using this information to solve problems (Reeves, 1999).

Emerging technologies allow instant access to any kind of information, but the impact of technology on teaching and learning still needs to be fully understood. New technologies demand teachers, administrators, parents, and students' knowledge to use this vast new resource to its maximum potentiality. Teachers need to learn how to integrate large amounts of new information into their curriculum and how to help students discriminate among so many vast sources of information. Schools need to help ensure equal access to information through technology for all students and to provide time and resources to faculty to help them stay current with the latest technology (American Youth Policy Forum, 2000).

Since the ICT revolution is a revolution in communication, it also has transformed available technologies, the means and methods of studying, the modality of school operations, the manner of investment and expenditure of resources, and the very way one thinks about what education could be and should do (Beebe, 2004).

Even before the Internet became a new mode of communication, and the World Wide Web made it possible to access learning material anywhere, universities started to use telecommunications and computers for teaching. With the advent of Internet and the web, these opportunities have expanded vastly, and educational institutions have made more and more varied use of them. Course material is posted on the web, assignments can be communicated through the net, and teachers can be accessed around the clock by the new modes of transmission. The new education programs not only reached out to off campus students, often from long distances, but they also reached out to regular students in novel ways by providing learning materials in new forms (Beebe, 2004).

Lane (2005) describes technology as a tool concerned with understanding how knowledge is creatively applied to organized tasks involving people and machines that meet sustainable goals. Information can be stored, retrieved and communicated using audio-visual images including print, numerical, pictorial and graphical representations through technology. It uses much more than scientific knowledge and combines values as much as facts, practical craft knowledge as much as theoretical knowledge.

There are many of new technologies that help as institutional tools in educations such as:

- a) **Interactive Whiteboard/ Digital Whiteboard/ Interactive Smart Board:** The instrument known by the above names can interface with a computer and a media projector in the classroom. One can project previously prepared text or images onto the whiteboard. What is written or drawn on the board can be converted to text or graphics and saved on the computer. One can also download data off the Internet and project it on the whiteboard (Smart board Technologies, 2008).

The whiteboard allows learners to absorb information easily and teachers to meet the presentation requirements. However, interactive whiteboards also have disadvantages, for they are more expensive than overhead and data projectors and their equipment are more sensitive and can easily become damaged, demanding expensive replacement. In addition to that, fixed-height boards are often too high to reach the top or too low for the bottom to be readily visible. A further disadvantage of the whiteboard is, if multiple data entry is allowed then inputs can get jumbled, resulting in onscreen gibberish (Brown, 2006).

- b) The Smartphone:** the smart phone is generally considered any handheld device that integrates personal information management and mobile phone capabilities in the same device. Often, this includes adding phone and computing functions to personal digital assistants (PDAs) and to Windows Pocket PCs, or putting "smart" capabilities, such as a clock, an alarm, reminders, e-mail, Internet browsing, word-processing, and spreadsheets into mobile phones for business purposes (Smartphone, 2008).

Mobile devices allow learners to get access and information outside the classroom. As mobile technologies progress to be more important in the lives of learners of the 21st century, schools are experimenting with the use of these popular devices for a range of different teaching and learning purposes. Although many experts believe that mobile devices have significant potential to transform the learner's learning environment, parents and teachers apparently are not yet convinced, for most teachers see mobile phones as distractions and feel that they have no place in school. The disadvantage of the m-Learning is the potential for distraction or unethical behaviour; physical health concerns, and data privacy issues (Shuler, 2009).

As stated by Oblinger (2008) in "On growing up with Google and what it means to education", mobile phones are not just for talking – they are also used for texting, sending photos, accessing the Web, or watching video. Mobile learning (m-Learning) can extend learning and teaching to anytime, anywhere. Learners can subscribe to the iTunes course and browse the file via a desktop, laptop or podcast via an MP3 player or iphone.

- c) **Global Positioning System (GPS):** refers to satellite-based radio positioning systems that provide a 24 hours three dimensional position, velocity and time information to suitably equipped users anywhere on or near the surface of the Earth (Global Positioning System, 2008).
- d) **iPod:** The generic brand iPod refers to a class of portable digital audio players designed and marketed by Apple computers. Most iPod models store media on a built-in hard drive, while a lower-end model, iPod shuffle, relies on flash memory (iPod, 2008).

Nowadays education and businesses are starting to use iPods in the workplace. iPods are being used to deliver training and education materials. One of the major educational uses for the iPod is its ability to store many clips for teachers to watch and listen to different types of training. As described by Read (2005), the main concept is that iPods do not have to be used merely for entertainment purposes; they can also be used for learning and mobile education. Not only does the iPod serve as a mass storage device, but it allows learners to record interviews, download lectures and create interactive lesson plans for assessment.

Another technology that goes along with this is called Podcasting. Podcasting allows organizations and individuals to send audio versions of textbooks or records of radio programs that can be downloaded and listened to at the user's leisure (Read, 2005). The user simply subscribes to a particular Podcast feed and the content is then downloaded to the user's computer or iPod. Using iPods in education can be a great way to keep learners and teachers up-to-date and ready to be as prepared as possible.

An increasing number of multi-media emerging technologies are becoming available to promote children's personalized learning experiences. The techniques of gathering, sorting, storing, retrieving and communicating information form a major technology. They are also used in solving challenges at schools across the complete range of technologies. One of the world's largest collections of children's literature, the International Children's Digital Library (ICDL) recently announced the free release of the ICDL for iPhone and iPod touch users to read a selection of books from the ICDL's master collection depository. The library contains thousands of children's stories from sixty countries (Shuler, 2009).

- e) **Game Machines Like PlayStation 3 and XBOX:** When connected to a TV or computer screen these machines can be used as standalone devices to play computer games, or for home networking (to integrate audio and visual forms of entertainment (PlayStation3, 2008).

Game machines like PlayStation 3 and XBOX encourage learners to develop different ways of learning and thinking such as: cognitive processing, logical thinking and independent decision making, and provide the opportunity to teach and practice new skills and encourage imagination, creativity and exploration. Shuler (2009) state that devices such as cell phones, iPod devices, and handheld video game consoles have features that can help learners to develop important skills they will need to succeed in the 21st century. Yet along with their potential comes difficult social, technological, and resource concerns that must be addressed.

2.9 RESEARCH QUESTIONS

Much of the literature review noted that technology is used in the USA, Europe and Africa for a variety of applications in education. For the latest in computer hardware, software and other digital devices use so that to curve ahead an articulated dissemination of information for quality education and optimal use of technologies; however, there are still some problems that need to be solved. These can be rephrased as the following listed questions:

- 1) What is the level of knowledge that teachers need to have to be able use emerging and existing technologies?
- 2) What type of network access do teachers and learners have at public secondary schools in urban and rural communities of KwaZulu-Natal to access knowledge resources?
- 3) What sort of training needs to be developed about Information Technology to enable teachers to implement e-Learning as part of e-Education?
- 4) How well are the technologies and its equipment maintained at public schools in KwaZulu-Natal?
- 5) How do the public schools use Information Technology as a communication tool to network with others within the school, in the local community, and expanding out to the global community at large?
- 6) How do teachers integrate Information Technology throughout the high school's curriculum?
- 7) Do teachers have adequate material to use Information Technology to support their personal and professional productivity through administrative applications and communication with colleagues and students via e-mail and throughout classrooms?

- 8) How dependent are teachers on the computer hardware provided to them?
- 9) For what purpose are the computers mainly used at school?
- 10) Do the principals understand the potential contribution of computer technology to learning?
- 11) Does the ministry of education understand the potential contribution of computer technology to learning?

2.10 CONCLUSION

It is clear that computers should be used as an educational tool, rather than a means of education. Nothing can replace the interactions between learners and teachers. It is important to find out how computer technologies are implemented in KwaZulu-Natal public secondary schools. The public secondary schools of KwaZulu-Natal must be proficient in using computers for learning systems, especially when they set up advanced education through e-Learning. Remote learning schools might encounter problems that can result from the characteristics of the separation of teachers and learners, such as the planning and preparation of learning materials by an educational organization; use of media, often print-based, to carry course content and to unite teacher and student; some form of two-way communication, and students learning as individuals.

In this rapidly transforming world, where employment requirements and fundamental literacy expectations are quickly changing, education must also change to meet these demands. The essence of education has been to transmit society's cultural heritage to successive generations and to foster competencies that will permit adults to successfully participate in society.

In short, in this chapter a wide range of the advantages of computer technology on the educational process were explained. Based on

what has been said before regarding computer technology, and in order to relate this to the current educational system of schools, most recent studies are explained in the next chapter and a sound methodology approach will be discussed in chapter four.

Chapter 3

RECENT RESEARCH FOCUSING ON E-EDUCATION IN PUBLIC SCHOOLS IN KWAZULU-NATAL

3.1 INTRODUCTION

In this chapter the researcher reports the recent research focusing on e-Education in public secondary schools in KZN regarding the use of ICTs. The researcher provided a detailed discussion on recent studies, and the role played by the South African government in enhancing skills development through e-Education. Education on the Internet is growing fast and one of the benefits is instant feedback. e-Education uses innovative technologies and online learning facilities to transform the way individuals and organization acquire new skills and knowledge. The South African Government will introduce e-Education in public secondary schools in KwaZulu-Natal by 2013. Before e-Education can be introduced in public secondary schools in KwaZulu-Natal by 2013 as premeditated in the South African Government's (White Paper on e-Education, 2004), it is important to monitor and report on the implementation of policy, norms and standards, assessing their impact on the quality of the educational process and identifying policy. Therefore, the overall research is being conducted within the framework of e-Readiness.

3.2 THE RESEARCH FRAMEWORK EMPLOYED IN RECENT STUDIES

This study is formulated as the researcher's response to the South African White Paper on e-Education. The main purpose is to put forward a research-based approach to the implementation of e-

Education in the urban and rural community of the province of KwaZulu-Natal, particularly the establishment of a robust, reliable and cost-effective ICT architecture to support the delivery, management and administration of the learning environment.

A common understanding of what e-Education entails is critical because of the potential impact, both positive and negative, of the use of ICT in Education with respect to the delivery, administration and support of education in schools. Blurton (2002) defines Information and Communication Technologies as a diverse set of technological tools and resources used to communicate, and to create, disseminate, store, and manage information; these technological tools and resources include computers, the Internet, broadcasting technologies and telephony. For the purposes of this research, the researcher has chosen to adopt the above definition as a functional definition of ICT. In this regard, any proposed architecture of the technology infrastructure that will support the implementation of the use of ICT to support Education (e-Education) will be based on the above definition of information and communication technologies (ICTs).

According to the White Paper on e-Education (2004) the concept of e-Education revolves around the use of ICTs to accelerate the achievement of national education goals. e-Education is about connecting learners and teachers to each other and to better information and ideas via the effective use of technology and through providing platforms for learning.

The South African national government has made it an explicit and urgent priority for the adoption of ICT in all schools (White Paper on e-Education, 2003). However, any e-Government initiative to improve ICT-adoption must be done in a way that is adapted to society needs and implemented in a way that ensures inclusion of all schools in KwaZulu-Natal thus decreasing disparities between rich and poor, urban and rural and within provinces. The government of South Afri-

ca responded positively to the challenge of bridging the digital divide. Certainly, there is a real problem of elevating only some and not others, thereby contributing to the digital divide. The study conducted by Mhlane (2007) indicates that there is a wide gap between those who can access and use ICT to gain the associated benefits, and those who do not have access to technology or cannot for one reason or another do so in KwaZulu-Natal.

The digital divide does not only relate to connectivity and infrastructure disparities but also relates to local content development in terms of the number and quality of local websites, building a domestic knowledge economy and promoting online business transactional capabilities. The digital divide also relates to the capacity of workforces to play roles in the Internet age in improving Internet access and educational offerings in all schools and colleges. This can be achieved by creating digital libraries for universities, promoting professional training institutes, and stimulating the economy to absorb teachers and learners (White Paper on e-Education, 2003). The term digital divide is used to refer to such differing standards or disproportion between countries fully poised to reap the benefits of the information age and those that are unable to do so (Bridge Organization, 2005).

Statistics and general information in South Africa are influenced by various factors such as the rapid redundancy rate of ICT resources, and the level of usage and sharing between schools in clusters. Besides, in respect of a national average and despite some extreme variations, schools in the Gauteng, the Northern Cape and Western Cape provinces have better ICT infrastructures than schools in the Eastern Cape and Limpopo provinces. The Free State, KwaZulu-Natal, Mpumalanga and North West provinces hold an intermediate position (DoE, 2004).

Telecommunications is the basis of the superstructure on which the architecture of the technology infrastructure of an information

and communication technologies regimen is founded. The architecture of the technology infrastructure that will support the implementation of e-Education in KwaZulu-Natal will be determined and defined by the state of the country's telecommunications infrastructure and its regulatory framework (Mhlane, 2007).

The Telecommunications Act has been promulgated by the Department of Communications (DoC) to shape the structure of the telecommunications industry in South Africa (Gillwald & Kane, 2003). However, the desired structure has eluded the DoC in that the South African telecommunications industry is created around a vertically integrated former monopoly, Telkom SA, which further competes downstream in the Value Added Network Services (VANS) segment of the telecommunications market (Gillwald & Kane, 2003).

The demand for more competitiveness in terms of telecommunication is also raised by Odero (2002) in the study he/she made on "e-Learning experience in Sweden and possible applications in South Africa," that the government has to encourage more telecommunication companies to invest in the country's infrastructure, and reduce tariffs on imported ICT products. This includes encouraging more competition amongst Internet Service Providers (ISPs). This will also bring down prices and possibly improve the quality of products and services.

Most South African schools lack basic physical infrastructure in the form of physical learning spaces, classroom furniture, running water and sanitation. The fact that Information and Communication Technologies (ICTs) include, inter alia, high-end technologies, poses a moral dilemma for the South African education authority, this is in respect of their general use to support teaching and learning in the school, because in most schools there are no basic teaching and learning resources. The majority of schools that answer to the above

description are found in KwaZulu-Natal, the Eastern Cape and Limpopo provinces (School Register of Needs Survey, 2000).

“Fundamental to an inclusive Information Society is ubiquitous, universal, equitable and affordable access to telecommunications infrastructure between, and within all communities. It is for this reason that governments should develop ICT policies that create an economic environment which is stable, affordable, predictable and competitive” (Mhlane, 2007).

The abovementioned government intervention in schools can be essential and fundamental. In fact, the affordability of broadband in South Korea’s schools did not come about by matter of chance but was a result of the Korean government deliberately driving down the cost of bandwidth (Otter, 2006). Investment in bandwidth infrastructure will not necessarily come from the private sector alone. It is for this reason that the South African government will have to make bandwidth a priority investment area.

The use of ICT to convey and support the curriculum in public schools in KwaZulu-Natal should not be considered in isolation, but rather within the context of broader social development, using the UN Millennium Development Goals (2008): the rights of each person on the planet to health, education, shelter and security, as well as to alleviate extreme poverty by 2015; as a roadmap towards achieving such social development. Issues of social development cannot, and should not, be separated from the fundamentals of the development of social and economic policies. The successful implementation of the White Paper on e-Education cannot be achieved outside the dictates of social development; therefore, makers and implementers of policy in South Africa will need to bear this in mind in their quest to bridge the digital divide.

3.3 THE 2003 WHITE PAPER ON E-EDUCATION

The fundamental objective of the 2003 White Paper on e-Education is to set out a framework on transforming learning and teaching through the ICT and to speed up the achievement of national education goals as well as to ensure that every school has access to a wide choice of diverse, high quality communication services (White Paper on e-Education, 2003).

e-Education is about linking learners and teachers to each other and professional support services and providing platforms for learning. e-Education will unite learners and teachers to better information, ideas and one another via effective combinations of pedagogy and technology in support of educational transformation. It supports larger systematic, pedagogical, curricular and assessment reforms that will facilitate enhanced education and better use of educational resources such as ICT (White Paper on e-Education, 2003). According to the White Paper on e-Education (2004), e-Education is broadly defined as using technology to deliver learning and training programs. It is typically used to describe multimedia such as CD-ROM, Internet, Intranet, wireless and mobile learning.

e-Education is more than developing computer literacy and the skills necessary to operate various types of Information and Communication Technologies. It is the ability to: (1) implement ICT skills to access, analyse, evaluate, integrate, present and communicate information; (2) produce knowledge and new information by adapting, applying, designing, inventing and authoring information; (3) enhance teaching and learning through communication and collaboration by using ICT; and (4) function in a knowledge society by using appropriate technology and mastering communication and collaboration skills (White Paper on e-Education, 2003).

The South African White Paper on e-Education (2004) affirms broadly that Information and Communication Technologies (ICTs) can be used as a tool for development in Africa. In order to deal with the problem of underdevelopment, Africa has adopted a renewal framework, the New Partnership for African Development (NEPAD), which identifies ICTs as crucial in the fight-back to reduce poverty on the continent. This entails the support, administration and delivery of education (e-Education), as well as the support, administration and provision of health services (e-Health); the establishment, maintenance and support of Small, Medium and Micro Enterprises (SMMEs) to stimulate the growth in the economy, and general public administration and governance (e-Government). The White Paper notes that the use of ICTs can provide hope for overcoming barriers to social and geographical isolation, increase access to information and education and enable the poor to participate in the making of decisions that have an impact on their lives.

Within education and training for regional distance learning, as reported by Mawandia (2006), the Botswana ICT Discussion Forum supports the White Paper on e-Education and recognizes the vital role of ICTs in the establishment and development of information infrastructure. Active use of it is inextricably linked to economic growth. Information technologies in general tend to be associated with productivity improvements even though this can be debatable in some circumstances. The utilization of the latest technologies is widely believed to be a source of competitive advantage and the technology industries themselves provide economic benefits to the usually highly educated populations that support them. The broad goal of developing the information economy involves some form of policy addressing the digital divide in many countries with an increasingly greater portion of the domestic labour force working in information industries.

According to the Markle Foundation (2001) Information and Communication Technologies can be used as a holistic approach for development. The Markle Foundation (2001) supports the White Paper by stating that ICT can be a powerful enabler (tool) for development because of its unique characteristics. ICT can dramatically improve communication and the exchange of information. It can also strengthen and create new economic and social networks and development in developing countries. ICT can allow remote communities to become integrated into global networks and make information, knowledge and culture accessible in theory to anyone. Through the creation and expansion of networks, ICT can transcend cultural and linguistic barriers by providing individuals and groups with the ability to live and work anywhere.

Quaynor (2002) supports the Markle Foundation (2001) by saying that the first step is to empower people while ICT is positioned as a management instrument for economic development and access for learning in the different societies. The second step knowledge products and services are focused as the economic output of ICT institutions in a sector. In this phase the use of information and a culture of innovation and creation are encouraged as social values; a knowledge society is the result. In the final step, a sustainable economy is built around knowledge products by securing the intellectual property that is uniquely African while ensuring that the quality of life is enhanced socially with the benefit of ICT.

Klopper *et al.* (2005) support Quaynor (2002) in that ICTs have the capacity to decrease marginalization and empower people fully by giving access to information. They also state that the introduction of ICTs, in combating the digital divide in the community, would provide isolated individuals with the opportunity to communicate. They argue that special attention needs to be given to the least developed countries, especially in Sub-Saharan Africa, with financial resources, phys-

ical infrastructure, and a knowledge base to achieve sustainable development goals. By implementing ICTs in working environments, employees directly promote technological changes in their organization and indirectly in society at large.

3.4 THE FRAMEWORK FOR E-READINESS

e-Readiness is the level of a country's telecommunications infrastructure and the capacity of that country to participate in the digital economy (UNESCO, 2008). The Economist Intelligence Unit (2008) defines e-Readiness as a measure of the quality of a country's information and communications technology (ICT) infrastructure and the ability of its consumers, businesses and governments to use ICT to their benefit. For instance, when a country uses ICT to carry out more of their activities, its economy can become more transparent and efficient. The e-Readiness rankings also allow governments to measure the success of their ICT strategies against those of other countries, and provide companies with the motivation to invest overseas with an overview of the world's most promising investment locations from the perspective of e-Readiness.

According to Bridges.org (2005) the concept of e-Readiness relates to how skilled and willing societies, regions, communities and institutions are to utilize ICTs to access and utilize global electronic resources for business, education, health, government, and leisure activities. It is the ability to use Information and Communication Technologies to develop one's economy and to foster one's welfare. e-Readiness is a very important skill that will play a vital role in the application of e-Education in schools. Skilled and willing societies are able to utilize ICTs to access and utilize global electronic technologies.

The exact definition of what constitutes e-Readiness is still open for debate (Docktor, 2002). Similarly Bridge.org (2005) points out that

there are many degree of e-Readiness and each could include a variety of tools. One report looks at where e-Readiness assessments have been carried out, and by whom; another report evaluates the various assessment models used including what they measure, their definitions of e-Readiness, and their underlying goals and assumptions which shape their outcomes. These reports provide a resource to policy-makers and others who want to use e-Readiness assessment results to plan for the integration of technologies in society, and to organizations that are considering new assessments.

The Economist Intelligence Unit (2008) uses six interrelated components to assess the current state of e-Readiness for each country. These are:

- 1) Connectivity and technology infrastructure: the access that individuals and organizations have to personal computer and Internet,
- 2) Business environment: the strength of the economy, political stability, the regulatory environment, taxation and the quality of infrastructure,
- 3) Consumer and business adoption: the e-Readiness rankings assess how prevalent an ICT practice is, in each country,
- 4) Legal and policy environment: ICT development depends both on a country's overall legal framework and specific laws governing Internet use,
- 5) Social and cultural environment: Literacy and basic education are preconditions to being able to utilize Internet services, but this category also considers a population's "e-Literacy",
- 6) Government policy and vision: the activities of governments in this area, and their ability to lead their countries towards a digital future,

South Africa is consistently placed in the middle band of most global e-Readiness indices. It was positioned 33rd in the Economist Intelligence Unit's 2002 e-Readiness rankings, out of a possible 60 countries from the developed and developing world (Economist Intelligence Unit 2002). The Economist Intelligence Unit (2008) publishes an annual e-Readiness ranking of the world's largest economies which currently include 70 countries assessed on their ability to promote and support Information and Communication Technology services. The statistics show that South Africa was ranked at 35 in 2007 and 39 in 2008.

e-Readiness is used to capture how nations across the globe fare in terms of creating, diffusing, adopting and using the various components of a networked economy. The e-Readiness assessment of a nation provides policy makers with a detailed scorecard of their economy's competitiveness relative to international counterparts in the digital era. The Economic Community of West African States (ECOWAS), the East African Community (EAC), the Southern African Development Community (SADC) and the Arab Maghreb Union (UMA) integrated to promote among African countries in the economic, social and cultural accelerated transformation and sustained development (Ifinedo, 2005).

According to the study conducted by Ifinedo (2005) measuring African e-Readiness in the global networked economy, it shows that the e-Readiness of South Africa is the best, with Botswana coming in second and that of the Cote d'Ivoire last. The two North African countries (Egypt and Tunisia) have scored equal to or better than the average for Africa. Likewise, southern African countries have e-Readiness scores that are relatively better than that of Africa's average.

It is hoped that South African policy makers and governments can make the most of the information herein; in particular, as they seek input for national development plans. Also, each district's e-Readiness score could be compared with future scores in order to as-

sess trends in e-Readiness for each province. It is widely acknowledged that e-Readiness is important for the reason that it influences the level of development benefits and outcomes that could accrue to citizens, government and business as necessitated by the use of ICTs.

3.5 FINDINGS ABOUT THE LEVEL OF E-READINESS OF LEARNERS IN RURAL COMMUNITIES AROUND DURBAN

Rural areas around Durban, South Africa, fall beyond the urban perimeter or sustainability line (eThekweni Area Based Management, 2005). These areas account for approximately 67% of the city's spatial footprint, translating into 1500 square kilometers and carrying a population of around 750,000. People live in dispersed settlements in traditional dwelling structures on communal lands along the periphery of the eThekweni Municipal Area (EMA). Rural areas in the EMA contain few social, physical or economic support amenities; people have access to neither library and information services nor public ICT facilities such as computers, Internet or e-mail (Seneviratne, 2007).

The province of KwaZulu-Natal has serious challenges in respect of physical services and telecommunications infrastructure. The study by Mhlane (2007) reports that just over 3 000 public schools in the province have electricity; around 2 000 have telephone lines; close to 5 000 public schools report that they have a computer(s) for administration, but over 3 000 claim that the computer(s) does not function; more than 5 000 public schools have no internet connectivity; and 80% of the schools in the province do not have a computer laboratory.

Domestic divides still exist between rural and urban areas, suburbs and informal settlements, men and women, racial groups, and income and education levels (Bridges.org 2002). Within South Africa there are wide regional differences: unlike the more rural provinces, Gauteng and the Western Cape have a relatively strong ICT infrastruc-

ture, including a burgeoning ICT sector (Bridges.org 2002). In the survey conducted by Van Belle & Vosloo (2005) only 7% of South Africa's population is online. Telkom, the only national telecommunications operator, is widely seen as stifling the potential of broadband and low-cost access through a monopolistic stranglehold on the sector.

The level of e-Readiness of learners in rural communities of KwaZulu-Natal is limited by poorly resourced ICT infrastructure. Nevertheless, some schools support the use of Information and Communication Technologies (ICTs) in education, and aim to address the inequalities of the past, in order to support the introduction of Curriculum 2005 and provide communication channels for use by educational institutions throughout KwaZulu-Natal (Curriculum, 2005). The study found that most schools in rural communities are unable to provide ICT services to community members because they do not have the funds to do so.

Findings about the level of e-Readiness of learners in rural communities around Durban can be easier said than done. Nonetheless, the KZN Department of Education needs to harness every available resource in the province, in the country and internationally to establish an interim educational network based on the existing commercial telecommunications infrastructure. It further needs to provide space and opportunity for small, medium and micro enterprises (SMMEs) which are based in the communities where the schools are to be part of the technical support and equipment supply and maintenance infrastructure of the province.

3.6 FINDINGS ABOUT THE LEVEL OF E-READINESS OF EDUCATORS IN URBAN COMMUNITIES AROUND DURBAN

The introduction of ICT to schools will create new possibilities for learners and teachers to engage in new ways of information selection,

gathering, sorting and analysis. In addition, ICT has the potential to enhance the management and administrative capacity of schools (White Paper on e-Education, 2004). The challenge of providing modern technologies to schools in order to enhance the quality of learning and teaching will require a significant investment.

The study by Mazibuko (2007), focusing on the extent to which learners around Durban are using e-Education and e-Learning in a school setting, reveals that less than 1% of Zulu learners around Durban in urban settings are using e-Education and e-Learning in school because of the unavailability of ICT infrastructure in schools and at home. Furthermore, she states that for the same reason, no learners have been utilizing commercial education and edutainment software for formal learning.

There is a severe lack of empirical research statistics on e-Readiness. It is the researcher's assertion that not much significant prior extensive research has been done about the state of e-Readiness of learners in KwaZulu-Natal public secondary schools. The only major studies found by the researcher are the studies that were conducted by Mazibuko (2007), Mhlane (2007), Nkabinde (2007) and Matsemela (2007). Nonetheless, these researchers drew information from a wide range of sources and empirical studies.

The e-Readiness in KwaZulu-Natal schools is mostly concentrated in urban areas and rural schools are hampered by constraining factors such as the lack of electricity. While the number of cybercafés across the region is indeed growing rapidly, this growth is almost entirely concentrated in urban centers. This leaves most rural technology users dependent on urban centers (Nkabinde, 2007).

The results of Nkabinde (2007) on the evaluation of attitude and level of knowledge of teachers in urban areas correspond with the results of Matsemela (2007) on attitude and self-reported competences

of teacher in rural schools. Both studies reveal that the teachers in public schools of KwaZulu-Natal are not exposed to advanced electronic communication technologies like computers and therefore lack the necessary skills to integrate technology to teaching and learning activities in class. It was evident from the analysis of the results of Nkabinde (2007) and Matsemela (2007) that teachers lack the necessary skills and knowledge to integrate technology into their teaching and learning activities as envisaged by the e-Education policy. The majority of teachers who participated in their study indicated that they have no access to computers at their schools. More interestingly, both results also reveal that teachers in public schools of KwaZulu-Natal are positive about the introduction of e-Education and would be willing to implement the policy in the classroom provided that they are given the necessary support. The limiting factors would be the lack of exposure to electronic communication technologies and also the lack of necessary resources, a situation that is prevalent in almost all the public schools in KwaZulu-Natal province.

The result of the research by Nkabinde (2007) specifically shows that the majority of teachers indicated that they have never received basic computer training. Furthermore, the results specified that in order for the teachers to effectively teach and manage all aspects of e-Education, they need ongoing support in the use of ICTs to support the curriculum. It was evident from the literature review that constructivist's theories emphasize social interaction as a basis for knowledge construction. A shift from teacher-centric instruction to learner-centric instruction is needed to enable learners to acquire new knowledge and skills. Shifting the emphasis from teaching to learning can create a more interactive and engaging learning environment for the teachers and learners.

3.7 FINDINGS ABOUT THE LEVEL OF E-READINESS OF EDUCATORS IN RURAL COMMUNITIES AROUND DURBAN

Over two-thirds of the schools in KwaZulu-Natal are in the rural hinterland. These schools cannot attract scarce Mathematics, Science and Technology educators. As such educators continue to be in demand in the well-serviced and comfortable urban areas (Mhlane, 2007).

The goal of the White Paper on e-Education (2003) is that all teachers, learners, managers and administrators will be ICT-capable by 2013. Even though South Africa spends over 20% of the national budget (R59.7-billion in 2006) on the delivery, support and administration of ICT in education, the country has not been able to turn the tide on the resource-related educational misery typical of poor and developing countries. This is manifested in the shortage of textbooks, equipment and other learning and teaching support material in the classroom (DoE, 2006).

Currently, the Department of Education emphasises strategic economic infrastructure, invests heavily in skills development and improvements in the quality of education, and makes important steps to boost the remuneration of health and education professionals. Together with this, in collaboration with University of KwaZulu-Natal and the Nelson Mandela Metropolitan University the DoE set training of 198 selected principals for an Advanced Certificate in Education Management. This is meant to equip principals with managerial skills to enable them to run their schools in a proper manner. The training of the school governing bodies is to better understand their roles and functions which will allow them to utilize maximally. The delivery of learning and teaching has over the past few years been improved considerably and currently by 98.5% (DoE, 2009).

The South African labour relations regimen further prescribes that certain types of schools have fewer educators as a consequence of a formula that was adopted in the Education Labour Relations Bargaining Chamber (ELRC); which formula is not based on educational considerations but class sizes and budgetary dictates. A typical example is that of educators who teach more than one grade at the same time in the multi-grade classes typical of most South African farm schools. There exists evidence that these educators could be supported by using ICT and, in that way, the resource problem that the country faces may be obviated, further maximising and optimising what resources already exist (DoE, 2006).

The research done by Matsemela (2007) on attitude and self-reported competencies of educators in rural schools of KwaZulu-Natal, reveals that educators in rural schools of KwaZulu-Natal are not ready for the rollout of e-Education. However, a result from the survey also reveals that educators in rural schools of KwaZulu-Natal are positive about the introduction of e-Education and would be willing to implement the policy in the classroom. Their ability to develop positive attitudes towards technology could be an indication of e-Readiness.

Furthermore, Matsemela (2007) as opposed to Nkabinde (2007) explains that the majority of educators in rural schools have received training in computer literacy privately at their own initiative, ranging from basic to intermediate level. This is an indication that educators are aware of the changes that are taking place in education and have taken the initiative to equip themselves with the necessary skills compatible with the demands of such developments. Unfortunately, as also stated by Nkabinde (2007), in urban schools, educators are not able to utilize their computer skills because of a lack of technological resources. They need to receive training in computer literacy that would allow them to use advanced communication.

Regarding exposure to technologies, the survey of Matsemela (2007) reveals that educators in rural public schools of KwaZulu-Natal are not exposed to advanced electronic communication technologies and therefore lack the necessary skills to integrate technology into teaching and learning activities in the classroom. Therefore, teachers have not been able to make use of their skill because of a lack of facilities to enable them to use such skills to improve their performance in the classroom. Although a significant segment of educators have managed to obtain training in computer literacy at basic and intermediate levels privately at their own initiative, they have not been able to utilize these skills in the classroom because of the lack of resources prevalent in rural schools. In relation to Mazibuko (2007) regarding perceptions and conceptions about e-Education, Matsemela (2007) also discovered that teachers have no access to computers at their workplace because most rural schools are poorly equipped.

The educators' attitudes and perceptions towards the use of ICT in education are closely related to how much educators are exposed to technology (White Paper, 2004). This brings the issue of technology availability and accessibility to the front. However, according to Matsemela (2007) and Nkabinde (2007) the lack of proper infrastructure was also cited as one of the reasons that contributed to this problem. The shortage of the necessary technology and telecommunications infrastructure in the rural areas is reflected in schools that are poorly equipped. These schools provide for poor rural communities who cannot afford to purchase such facilities for their schools.

The findings of the study of Nkabinde (2007) and Matsemela (2007) indicate that there is a lack of the necessary technological infrastructure and resources as mentioned above to enable KZN schools to implement e-Education. Even if there is a lack of the necessary technological infrastructure, educators in rural schools are using cell phones for a variety of functions; from day to day communication to

more advanced functions like conducting business matters through mobile phone online connections. This indicates a possibility of educators leapfrogging from using personal computers to sophisticated mobile technology.

3.8 CONCLUSION

In this chapter the researcher outlined the various sources of information that were utilized to gather empirical information on recent research focusing on e-Education. The Economist Intelligence Unit (2009) began examining the role that information and communications technology (ICT) plays in driving the world's economies today; more people have a mobile device than do not, and the distribution has spread mightily throughout the developing world. Nearly one-half of all mobile subscribers are in Asia, and around 10% each in Africa and Latin America. Efforts are being made by world banks and WEF to enhance African e-Readiness status in e-Education.

Teachers in urban public schools of KwaZulu-Natal are positive about the introduction of e-Education and would be willing to implement the policy in the classroom provided that they are given the necessary support. The limiting factors would be lack of exposure to electronic communication technologies and also lack of necessary resources, a situation that is prevalent in almost all the schools in KwaZulu-Natal province. It was evident from the Matsemela (2007) and Nkabinde (2007) analyses that teachers lack the necessary skills and knowledge to integrate technology into their teaching and learning activities as envisaged by the e-Education policy.

It was evident as well that a shift from teacher-centric instruction to learner-centric instruction is needed to enable learners to acquire new knowledge and skills. Shifting the emphasis from teaching to learning can create a more interactive and engaging learning environ-

ment for the teachers and learners. The majority of teachers are computer illiterate and therefore this study recommends that basic computer skills training should be a starting point. Training should include basic computer literacy, and exposure to computer technology resources in the classroom.

It is clear that something needs to be done by the government to enable urban and rural communities in KwaZulu-Natal to use ICTs in their day-to-day activities, and to communicate with the rest of the world. Technologies such as the Internet connectivity should be provided through wireless systems in order to reach rural communities that are not connected to the national power grid or telephone network. The possibility of laying fibre optic cables which offer more advantages over copper and coaxial cables between all the major towns and cities in order to achieve a faster, higher quality of Internet access, should also be considered.

In the next chapter the researcher will give an account of the research methodology that was employed to solve the problems that were identified in the first three chapters.

Chapter 4

RESEARCH METHODOLOGY

4.1 INTRODUCTION

In the previous chapter the researcher conducted a review of recent research focusing on e-Education and then formulated a theoretical framework for analyzing the empirical result of the research. In this chapter the researcher explores the research methodology in general and techniques that were used to complete the thesis. This includes the nature of the research methodology, design of the research tools, procedure followed in preparation, the data analysis techniques and the data collection method that was employed and the data preparation.

The research design section clarifies what the research design is, and its focus, as well as the unit analysis, the structure of the survey used to gather data, the types of the research design and what kind of result it is aimed at and what kind of evidence is required to address the research question adequately (Lubbe & Klopper, 2004). The data collection method explains the facts, data and measurements of the chosen data collection techniques.

The nature of the research design begins with a selection of the title of the topic and the way the research is conducted (research methodology). These basic decisions will affect how the research will be conducted and what constitutes legitimate problems, solutions and criteria. For a profound and solid research methodology, different techniques such as quantitative and qualitative research approaches

are usually used to solve the research problems (Lubbe & Klopper, 2004).

Generally this research will involve an analysis of what tools and techniques will be used, how the research will proceed to carry out these activities, how progress will be measured, and what constitutes success. According to Joppe (2004) basic quantitative and qualitative research techniques, concepts and terminology should be able to provide this information in an easily accessible format and non-technical language.

A combination of qualitative and quantitative method of research could be used to solve identified research problems. This is known as mixed method research design, and often overlaps in conceptual frameworks. The researcher decided to use quantitative rather than qualitative or mixed mode research. The quantitative method will maximize objectivity by using a descriptive design to characterize individuals in group contexts and a correlation design to assess relationships between two or more phenomena.

4.2 THE NATURE OF THE RESEARCH METHODOLOGY

Following the normal research procedures, the design should address the methodology, empirical studies, relevant issues, and topics for statistical analysis. The nature of the research methodology section describes how the researcher will obtain the data and material needed to carry out the design. Firstly the data sources will be covered detailing the basic sample population and methods used. Following the method used, the instrument of research will be discussed.

4.2.1 Sampling Techniques

Sampling is the act, process, or technique of selecting a suitable sample, or a representative part of a population for the purpose of de-

termining parameters or characteristics of the whole population. When selecting an audience one can do either a population study or a sample study. A population study encompasses all elements; however, this may be far too costly in most circumstances so one would usually do a sample study (Trochim, 2006).

Sampling can be divided into two types, that is probability sampling and non-probability sampling. Probability sampling is a method of sampling that utilizes some form of random selection. This means that the sample is selected in such a way, that each unit within the population has a chance of being selected. With non-probability sampling, the sample is selected in such a way, that the chance of each unit within the population being selected is not known (Trochim, 2006).

For this research study a group of 300 respondents were selected to fill in the questionnaire. The questionnaire that was used in this study to collect the desired raw data from teachers spread out in urban and rural communities of KwaZulu-Natal was based on purposeful/purposive sampling. The purposeful/purposive sampling was selected to choose subgroups of interest, and facilitate comparisons. This purposive sampling selection was applied not only to the respondents but also to different areas of school locations as well.

Purposive sampling as described by Patton (2001), is a non-random method of sampling where the researcher selects profound information-rich case from which one can get abundant data for the purpose of the research. For instance, if the purpose of the study is aimed to enhance the effectiveness of the survey of poor socio-economic groups, the researcher may learn more by giving careful attention to understanding the requirements and needs, interests and incentives of a small group rather than gathering standardized data from large groups (Patton, 2001). The reason purposive sampling se-

lection was used, is because it was believed that each respondent and area would get an equal chance of being selected as participants.

4.2.2 Sample Population

Smith (2008) defines population as the process through which a group of representative individuals is drawn from a population for the purpose of a statistical analysis. The target population (people) who participated in this study were the teachers in the public secondary schools of KwaZulu-Natal. There are 453 public secondary schools in the district of the Ethekwini Metropolitan area and 1456 public secondary schools located in KwaZulu-Natal province of South Africa (EMIS, 2007).

The researcher focused mostly on Ethekwini Metropolitan schools. The reason for selecting mostly schools from the Ethekwini Metropolitan areas is firstly, teachers were in an easily accessible geographical areas, and secondly since they were close to urban areas, it was not time-consuming to the researcher to do the fieldwork. Nevertheless, exploring computer technology usage among more remote areas was also carried out. However, if remote rural area schools did not qualify for basic technological infrastructure (i.e. having computers at school) they were discredited for the study because they did not qualify for having the basic technological requirements.

4.2.3 Sample Size

Trochim (2006) explains sampling as the process of selecting units such as people or organizations from a population of interest so that by studying the sample one may fairly simplify the results back to the population from which they were selected. The intended sample size for this study is the number of participants planned to be in-

cluded in the population and usually determined by using a statistical sample size.

The target population consisted of individuals from the KwaZulu-Natal area. There are nearly 64500 teachers spread out in the Etheke-wini Metropolitan area, around 453 public secondary schools and 253,500 teachers in the KwaZulu-Natal province, and around 1456 public secondary schools in the urban and rural communities of KwaZulu-Natal (EMIS, 2007). Therefore, for this research study a sample size of 300 respondents is selected from at least thirty different schools in urban and rural communities of KwaZulu-Natal to fill in the provided questionnaire. In addition to the questionnaire, a participant observation was used to gather information from a hundred of the 300 initial respondents to determine to what extent their self-reported data about their computer skills can be accepted as correct.

Overall four hundred respondents were chosen to constitute valid data. Statistically this sample size is valid to approximately one million people. This sample was chosen because it yields a conclusive set of results for analysis purposes and would constitute a valid sample to one million people (Lubbe and Klopper, 2004).

4.3 DESIGN OF RESEARCH TOOLS

A research design refers to the plan and structure of the investigation used to obtain evidence to answer research questions. The design indicates how the research is structured and developed, what happens to the subject and what methods of data collection are used. Since there are various types of research questions and many types of designs, it is important to match the design with the question.

There are two types of research design: quantitative and qualitative. The researcher predominantly will use quantitative design as it is more structured than the qualitative. By including closed format

quantitative design the researcher can easily calculate statistical data and percentages. Preliminary analysis can also be performed with ease. Closed format questions can be asked to different groups at different intervals.

Close-ended questions were used to determine the preferences of respondents regarding e-Education related issues by allowing the respondent to choose an answer from a list provided. Open-ended questions at the end of the questionnaire were also used to allow respondents to express their subjective opinions. Based on the research methodology guidelines of Lubbe and Klopper (2004) the following types of questionnaire were provided:

- 1) **Dual Response Questions:** These are yes/no questions used to classify the respondents into distinct groups.
- 2) **Multiple Choice Questions:** the respondent is asked to select one answer from a list of choices.
- 3) **Checklist Questions:** Such questions will ask the respondent to give one or more responses from a list. In order to avoid confusion between Multiple Choice and Checklist Questions, an instruction is usually included such as check one only or as many as applies and so on.
- 4) **Likert-Scale Questions:** These types of closed-ended questions allow the respondent to arrange their responses from a given choice corresponding to the instructions given.
- 5) **Rating Questions:** In rating questions the respondents are asked to rate response categories or give their opinion about an issue or statement such as agree, disagree, neutral, etc.

4.4 DATA COLLECTION METHOD

This refers to the manner in which data is collected from selected samples and techniques where the researcher sets up the information

gathering methods based on the facilities available, accuracy required, time span, expertise of the researcher and financial resources. It is therefore important that appropriate and reliable methods are used in order to accomplish valid and reliable results. Surveys, observations, focus groups and questionnaires are methods frequently used.

The selection of data collection tools depends on multiple types of research. Any method selected has its own advantages and disadvantages. Hence, it may be necessary to select two or more methods of data collection (triangulation). In such case the weakness of one method can be counterbalanced by the other method. Because the use of a single data collection method can lead to inadequate and less valid and reliable data, it may also bias or distort the researcher's picture. Validity refers to the degree to which the evidence supports that these interpretations are correct and that the manner in which the interpretations are used is appropriate. The extent to which results are consistent over time and an accurate representation of the total population is referred to as reliability (Livesey, 2008).

The research data were personally collected by the researcher after ethical clearance had been obtained from the University of KwaZulu-Natal, as well as when the required permissions obtained from the KZN Department of Education.

Data are collected mainly from primary sources. A primary source reflects the individual viewpoint of a participant or observer. It is information that is obtained directly from first-hand sources by means of surveys, observation or experimentation (Lubbe & Kloppe, 2004).

4.4.1 Observation-Based Surveying

In addition to questionnaires direct observation is used to collect information or data from a live situation, watching teachers engaged

in activities and recording what occurs. The observation and questionnaire methods are the most applicable and popular means of collecting data because surveys work best when questions are simple and easily understood by the respondent. Observation-based surveying is cheaper if the researcher uses organized and structured questions that specifies in detail what is to be observed and how the measurements are to be recorded. In the observation-based surveying, the observations are typically individual respondents and the variables are responses solicited from questions about attitudes, behaviours and traits.

There are two types of observation: participant observation and non-participant observation. As observation needs a careful follow-up for validity and reliable collecting of data the researcher worked through participant observation. That means the researcher participated directly and observed, even though it took longer to conduct the research.

Observation is a technique focuses on watching behaviour, with a strong emphasis being placed on non-verbal cues. However, listening is also important as many considered it a method for studying behaviour as it occurs in a natural environment. This method is useful when it does not manipulate or intervene in a particular aspect of behaviour.

Compared to questionnaire-based research, observation is far more time consuming, although it usually provides the researcher with deeper insight into the problems under investigation.

4.4.2 The Questionnaire-Based Surveying

The common means of collecting data are the quantitative questionnaire rather than qualitative that gives the respondents an opportunity to express their opinions. In these formats of questionnaire,

there are no predetermined set of responses and the respondents are free to answer however he/she chooses. A questionnaire is a set of questions designed to collect information on a subject from a respondent. Question can be either an open-ended format or closed-ended format. However, in order to obtain valid and reliable results, one needs to choose the questions prudently. There are many steps and procedures that one can follow as a guideline when creating a questionnaire.

The researcher mainly used the questionnaire that is set with closed-ended type of questions to ensure that teachers do not need too much time to complete the questionnaire. It includes demographic factors like gender, age and occupational category (Lubbe & Klopper, 2004).

4.4.2.1 The Advantages of Questionnaire-Based Research

It is important to understand the advantages and disadvantages of the questionnaire. This knowledge will allow a researcher to maximize the strength of the questionnaire while minimizing its weakness. Apart from saving time, the importance of using a questionnaire is because it is simple and avoids confusion. It is easy to analyse using modern statistics and spread sheet programs. It reduces bias, in that there is no pressure on the respondent to answer questions in a certain way.

Questionnaires as opposed to other methods of data collection (e.g. interviews), eliminate unexpected suggestions, and do not cost much money or time to gather data from a potentially large number of respondents. Often they are the only possible way to reach a number of reviewers large enough to allow statistical analysis of the results. Questionnaires are means of collecting data, but are difficult to design and often require much work before an acceptable questionnaire is produced. A well-designed questionnaire that is used effectively can

gather information on both the overall performance of the experiment as well as information on specific components of the system.

Furthermore, the reasons why the questionnaire was chosen are:

- 1) There is no need of prior arrangement.
- 2) It is flexible in what it can measure.
- 3) It can be posted, e-mailed or faxed.
- 4) It is cheap to administer compared to other data collection methods.
- 5) It covers a large number of respondents.

The questionnaire needs to be designed carefully because the final results are only as good as the strongest and best in the initial questionnaire process. Thus, it gives a better sample that enhances the conduct of a large and more representative sample and provides a standardized data gathering procedure.

4.4.2.2 The Disadvantages of Questionnaire-Based Research

The primary disadvantage of the questionnaire is non-returns, individual questions that are not answered by the people to whom they were sent, or misinterpretations by the respondent that does not understand either the survey or questionnaire properly. Therefore, sometimes it is not as easy as it sounds and there are quite a lot of disadvantages as well, such as:

- 1) Closed-ended format questions can create very large amounts of data that is difficult to analyse and to correlate in charts.
- 2) Respondents may answer inaccurately and sloppily especially if the questionnaire takes a long time to complete.
- 3) Most of the standard questionnaires are in options format to answer, therefore some respondents are not keen to answer

what might be difficult to them. They just prefer to choose from the option boxes to cross or to tick rather than to ask what is not clear to them.

- 4) It is not easy to develop the response categories. Unclear response categories can create problems.
- 5) Respondents also do not have the chance to expand upon a response thus the issue being studied can be oversimplified.
- 6) Problems with incomplete questionnaires. Respondents can quickly read all the questions beforehand and then decide whether to complete it or not, for instance, maybe because it is too long, too complex, uninteresting, or too personal. As a result of this, a problem with an incomplete questionnaire occurs.

4.4.3 A Brief Characterization of the Questionnaire

The questionnaire was designed once the literature review had been completed, and potential barriers and critical areas of concern were identified. Permission from the provincial education department (KwaZulu-Natal Department of Education) was requested to disseminate the questionnaire. Afterwards, the researcher started to distribute and collect data when permission was obtained from principals of KwaZulu-Natal schools to conduct the research study.

The questionnaire was structured with a combination of closed-ended, multiple choice questions, and semantically anchored four point Likert scale questions. The questionnaire is divided into 3 parts. Below are breakdowns of the questions:

- 1) **Part 1:** Questions 1-7 include personal information about age, gender, area and race, experience, years of teaching and level of teaching (standards) of the teachers involved.

- 2) **Part 2:** Questions 8-23 include general information especially access to computers resources available to teachers and the teaching environment, school policies and practices regarding effective use of computers, communication instruments, electronic learning facilities, time management and the level of their skills, and whether they are at home or at school. Apart from question 8-13 and 21-23, all questions contain subquestions that entail respondents' theoretical computer skills, measured as basic, intermediate and advanced level of computer skills.
- 3) **Part 3:** Question 24 asks about observation of respondents' practical computer skills. This is a selective assessment of three computer skills in relation to respondents' prior statements about their level of literacy, giving three different practical format questions to which they have assigned their knowledge of skills as basic, intermediate and advance.

At the end of the questionnaire respondents were given the open-ended format question to express their opinions about suggestions for changes or improvements

4.4.4 Administration of the Questionnaire

Before disseminating the questionnaires to the respondents, the survey trial method was developed by the researcher for any suggestion to be made for the final draft of the questionnaire and for that reason, a pilot-test was completed by a group of 30 teachers. After some revisions were made to the instrument based on the pilot test results, the final and updated questionnaire was disseminated to school teachers.

The survey was administered at the end of the second semester 2007 and at the beginning of the first semester 2008.

The researcher used the advantages of collecting data from different respondents who participated in an International Computer Driving License (ICDL) workshop. The workshop was held by the province of KwaZulu-Natal Department of Education for Computer Application Technology (CAT) and IT teachers in different places of Durban. It was indeed a great occasion to find many teachers from different areas of schools at once. The first workshop was held from 4 September to 19 November 2007 and the second from 21 to 25 July 2008; notifying in advance for permission to conduct research to the main facilitators of the workshop. The rest of data collection was also carried out in different schools notifying in advance for permission to conduct research to the principals of public secondary schools.

4.5 DATA ANALYSIS TECHNIQUE

During the survey the teachers were required to mark their responses using a cross or a tick next to the appropriate response. The total number of questionnaires returned was 301 out of 330 that were distributed to the 30 surveyed schools. The responses were then entered into the SPSS 15 statistical program for analysis.

In data analysis the researcher arranges and portrays the data in ways that help detect patterns and to explore associations that exist in the data, to determine if the data are consistent with their hypotheses and theories, or to determine whether the data provides answers to the research questions posed.

The quantitative data obtained from the sample population was then captured onto the computer using the application software SPSS 15. However, as was mentioned earlier, Microsoft Office Excel was also used for certain preferences in analyzing graphs. Statistical procedures, including Pearson's correlations, were then used to identify any correlations means and trends from the quantitative data collected.

Coding and analysis of the data was then conducted in these programs. Incompletely filled in forms were disregarded.

4.6 DATA PREPARATION

Data preparation entails editing and coding. The information in this topic often refers to large-scale projects, since errors in data preparation generally cause vivid inaccuracies in such a project. If a questionnaire is not needed and has to be discarded, one might lose a fair percentage of the data that was expected. To avoid inaccuracy some knowledge of editing and coding procedures were necessary.

In this section the common methods of data coding and data editing constructions were examined. Knowing the right questions and understanding the answers, will not only be reassuring for the research finding, but will give convincing arguments as well to the research results.

The main reason of editing is to examine the collected raw data in order to be sure that it is accurate. The completed questionnaire was checked for overall accuracy, completeness and general usability. The number was given to assign respondents' answers to pertinent response categories. The reasons for using these are:

- 1) The effectiveness of the entire analysis function may be hampered because of poor editing and coding.
- 2) To evaluate the effectiveness of the questionnaire.
- 3) The presence of ambiguity will be evaluated and checked.

4.7 CONCLUSION

Chapter four discussed the research methodology followed in conducting the research. Upon completion of this chapter the reader should now be aware of what methodology was utilized within this

study, as well as the reasoning behind the structures and processes involved. One can also see after reading this chapter that there were a number of areas where improvements could be made, thus reducing the level of error and improving the reliability of the data gathered. Chapter five will analyse the results obtained from the questionnaire.

Chapter 5

RESEARCH RESULTS

5.1 INTRODUCTION

In the previous chapter the researcher clarified various aspects of the research methodology that was used to conduct the empirical phase of this study. This chapter presents the data and information obtained from the empirical phase of the research. It provides the analysis of the research findings and implications relating to preparing teachers to effectively integrate systems and emerging technologies in adopting ICTs. It also presents statistically processed data, followed by discussions and interpretations.

As was indicated in the previous chapter the data was gathered through random purposeful sampling to add credibility to the sample, when the potential purposeful sample is larger than one can handle. The questionnaire was distributed to 300 teachers of public secondary schools in urban and rural communities of KwaZulu-Natal. Out of 300 respondents 100 respondents were also given a practical review test to determine to what extent respondents' self-report data about how effectively computer skills are used.

As stated in chapter four, the researcher analysed the figures of the data and findings by using both SPSS 15 and Microsoft Excel 2007 application software.

5.2 DEMOGRAPHIC DATA

Three hundred respondents participated in the study. The demography of the 300 respondents in terms of gender, age and race is presented in the following subsections.

5.2.1 Gender

The gender distributions of the respondents are shown in Figure 5.1. The gender distribution of teachers responding to the survey indicated that out of 300 purposive randomly selected respondents, 56% are female respondents and 44% are male respondents. Although it is not the main purpose of this study, it is worthwhile mentioning the possible reasons for the higher number of females than males in the purposive randomly selected respondents.

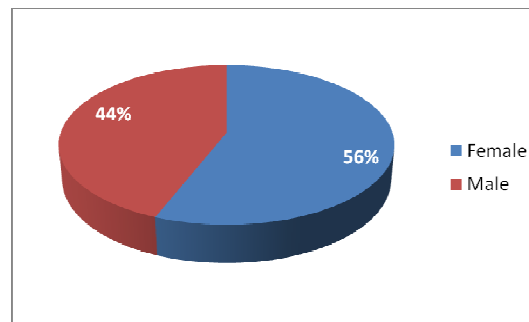


Figure 5.1: Gender distribution of respondents

Since gender equity can be an important issue in identifying the benefit of human progress in terms of health, economy and development of countries. It is an essential and decisive factor to make sure those teachers reflect equity on labour force; the result of the respondents shows the prevalence of female gender over male gender in public schools.

5.2.2 Race

Figure 5.2 describes the racial groupings of the respondents involved in completing the questionnaire and in Figure 5.3 the race distribution of South Africa at large. It is believed a fairly representative reflection of the race distribution is displayed in the sample size. South Africa is a nation of over 47-million people of diverse origins, cultures, languages and beliefs. According to the mid 2007 estimates from statistics of South African Information Material (2007), the largest provincial population is in KwaZulu-Natal. The country's population is at some 47.9-million, up from the 2001 census of 44.8-million. Africans are in the majority at just over 38 million, making up 79.6% of the total population. The white population is estimated at 4.3 million (9.1%), the coloured population at 4.2 million (8.9%) and the Indian/Asian population at just short of 1.2 million (2.5%).

Indians/ Asians are the lowest in number of the South African population (See Figure 5.3). However, this group's race sample distribution in KZN area (See Figure 5.2) consists of the second largest number (32%) that is double the size of white population and almost three times that of the coloured population. This is still a fairly representative distribution because in comparison with the other provinces of the South Africa, three quarters of the Indian population resides in KwaZulu-Natal.

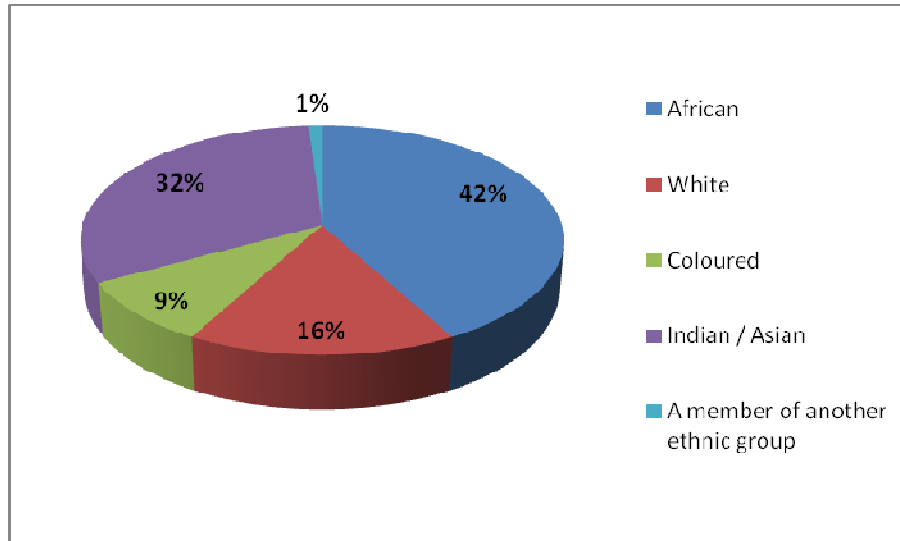


Figure 5.2: Race distribution of respondents in KZN

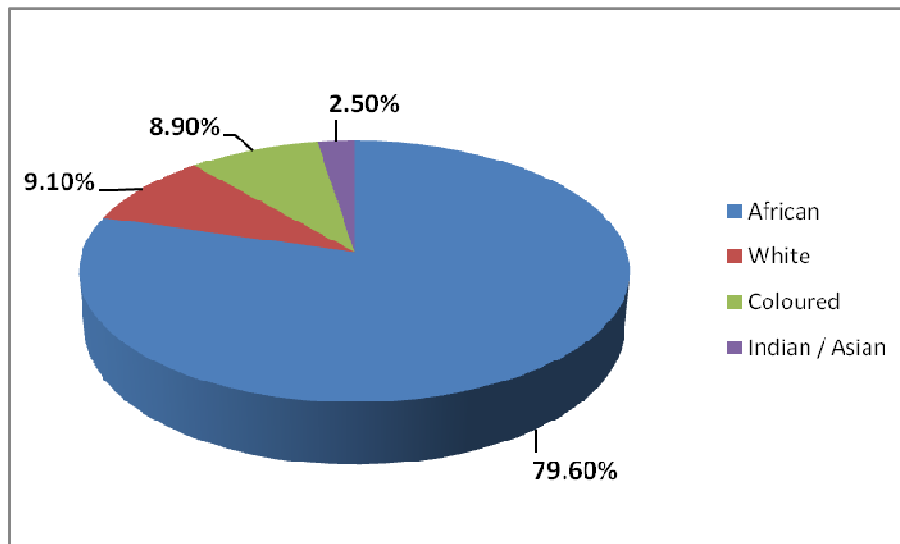


Figure 5.3: Race distribution of South Africa

5.2.3 Age

Generally there are three defining age group brackets in a country's population economy (See Figure 5.4). The first group is the youngest being placed at the bottom of the pyramid, i.e. the infants

and children. The next group is the tax payers or working class people; this is the group that determines the country's economy and how much productivity a country has to offer. The last is the retiring or ageing group of people; these are the bracket in the country's population that depends on government grants and pensions. The pensioners rely mainly on income from the government, which comes from the tax-payers (working class people); and similarly the first group (infants and children) does not contribute to the taxes in a country, but benefit from its existence.

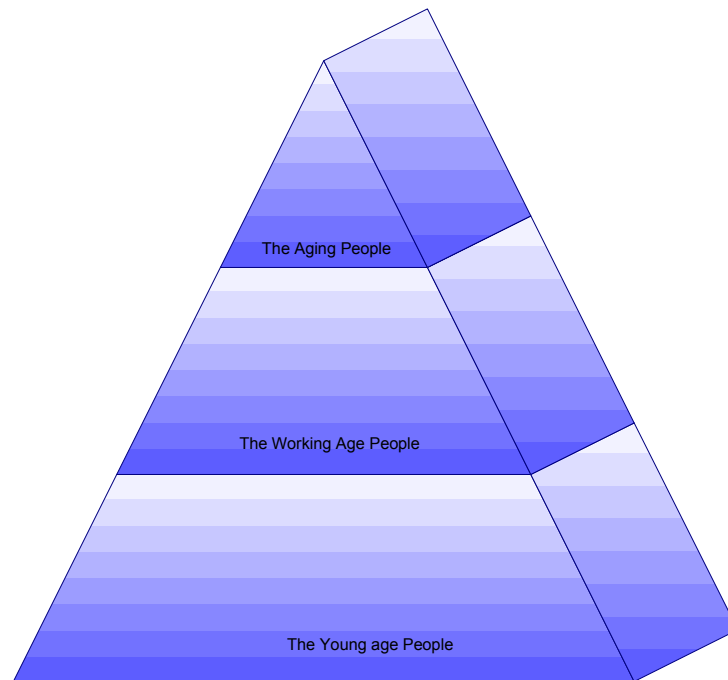


Figure 5.4: The age group brackets

Based on the above Figure 5.4 which illustrates three generally defining age group brackets, percentage of respondents in different age ranges is presented in Figure 5.5 and number of respondents in different age ranges is tabulated in Table 4.1 below. The result indicates that 22% of the respondents to the questionnaire falls between 20 to 29 (68 out of 300), 43% of respondents between 30 to 39 (129

out of 300), 25% of respondents between 40 to 49 (74 out of 300), 9% of respondents between 50 to 59 (26 out of 300), and the rest 1% of respondents to 60 or older (3 out of 300). Productive age is a range of age when people can work for paid employment optimally (Conrad, 2004). More than three quarters of the age group of the respondents will be productive for long period, even though eventually 9% of teachers will retire within 10 years being 60 or older.

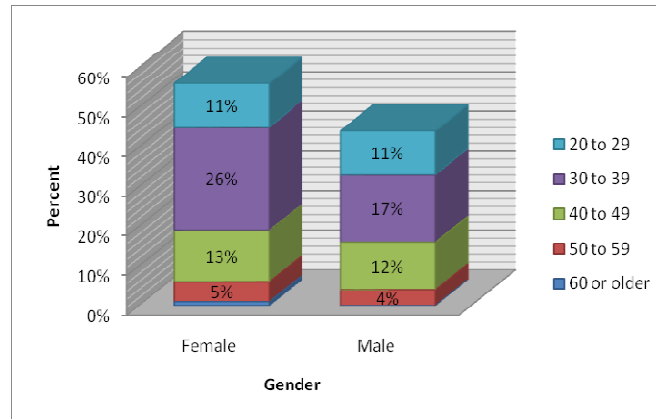


Figure 5.5: Percentage of respondents in different age ranges

Respondents' Age Groups	Gender	
	Female	Male
	Count / Percent	Count/ Percent
20 to 29	34 (11%)	34 (11%)
30 to 39	78 (26%)	51 (17%)
40 to 49	39 (13%)	35 (12%)
50 to 59	14 (5%)	11 (3%)
60 or older	2 (1%)	1 (0.5%)
Total	167	133

Table 5.1: Number of respondents in different age ranges

Ninety percent of the public school teachers of KwaZulu-Natal are younger than fifty year age and part of the working population, even though eventually 10% of teachers (over fifties) will retire within 10 years being 60 or older. An increase in the portion of the working age population can yield a “demographic dividend” that enhances the rate of economic growth, with the largest number of young person being placed at the middle of the pyramid bracket.

Roughly three quarters of the entire age group of the respondents are a young age. This age structure can be relevant to identify that people of different age have different needs, responsibilities and abilities.

5.3 GEOGRAPHIC REPRESENTATION OF RESPONDENTS

Respondents were targeted from different geographical locations to give an equal chance to all. Figure 5.6 below shows the percentage constitution of the different districts that schools of teachers were located.

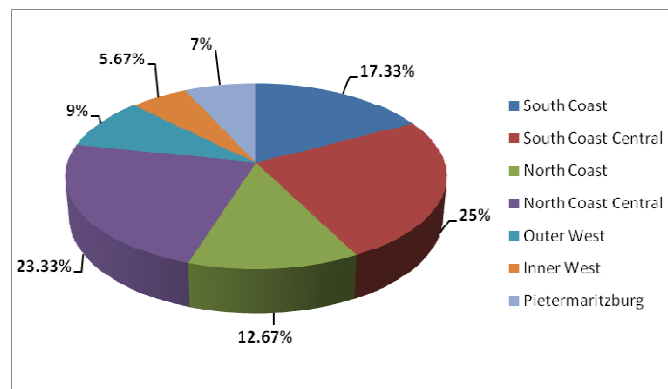


Figure 5.6: The districts where respondents are located

The result found that the majority of respondents are from South Coast Central (25%) and North Coast Central (23%). The rest of the respondents are from North Coast (13%), Inner West (6%), Pieterma-

ritzburg (7%) and Outer West (9%) of KwaZulu-Natal respectively. Regrettably, the Inner West, Pietermaritzburg and Outer West of KwaZulu-Natal had a lesser number of respondents. The result found the majority of the respondents are from urban area and this will certainly help the researcher to clarify why most teachers are from urban geographical locations.

The area where teachers grew up and the area where teachers teach or currently live are illustrated in Figure 5.7. The result shows an equally average of distribution of teachers of where they grew up and where they teach both in semi-urban and urban areas. In a rural area there is only a 2% difference as to where they grew up, almost balanced result generated.

However, there is a double size gap between the rural (44%) and urban area (21%) where teachers teach and where they grew up. Rural schools tend to have a smaller number of teachers than urban schools and this carries fewer benefits for rural learners. Rural schools can face challenges that can lead to unfavourable educational outcomes for the learners. Most teachers are teaching in urban areas and that could be at a disadvantage relative to rural areas, with respect to finding skillful personnel for Information and Communication Technologies (ICTs). Educational outcomes may be more encouraging in urban areas simply because urban economic conditions probably provide greater income on investment in education.

As the result in Figure 5.7 reveals, the areas where the teachers teach and where they grew up are higher in urban and semi-urban respectively, the reason could be schools in the rural areas are possibly poorly equipped and lack the resources that are necessary for the delivery of quality education. Usually, rural areas have poor IT infrastructures but that is not necessarily true to be applied to all the rural areas. As researcher directly observed during his dissemination of questionnaire, some rural areas have far better equipment than urban

area; for instance having an interactive whiteboard in their learning facilities. However, generally the result found the areas of the teachers teach and where they grew up is higher in urban and semi-urban unlike rural. The working conditions at these schools therefore are not encouraging for delivering effective teaching and learning and would hardly attract educators. The large number of educators who work in urban schools could be attributed to the shortage of vacancies prevalent in rural schools.

Principals can foster conditions that encourage teachers to remain in their location. This can include being careful in assigning new teacher workloads, establishing encouraging and friendly innovative classroom teaching strategies, and providing opportunities to interact with new technological equipment among them.

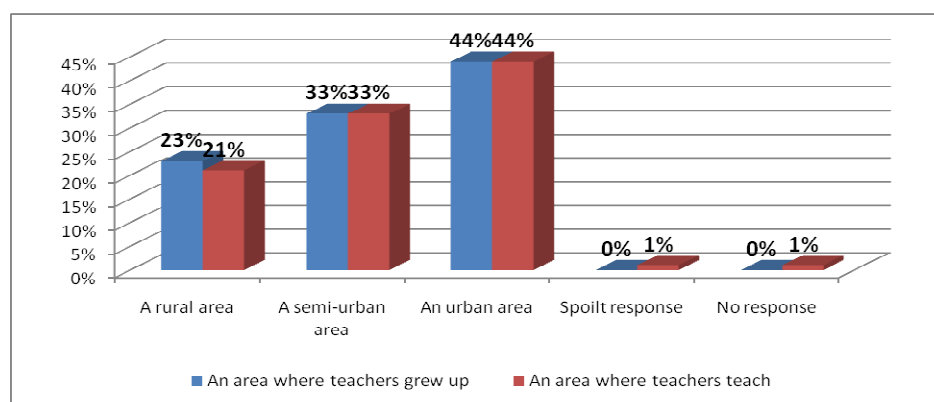


Figure 5.7: The area where teachers grew up and where they teach

5.4 ACCESS TO COMPUTERS

To ascertain whether teachers who work in rural and urban schools have adopted the basic communication technologies and the frequency at which access to computers are used, and so to estimate the demand for more access and training, respondents were asked if they do have access to a computer at home. Within this category 82% of the population has access to a computer at home. The respondents

that did not have computer access at home are reflected as 17%, and both spoilt and no responses to 1% (See Figure 5.8).

As indicated in Figure 5.8 below, it is interesting to note that the majority of teachers in the KwaZulu-Natal area have computers at home. The large number of educators with computers at home could be an indication that many teachers either are in a better position financially or are very interested to cope with fast pacing technologies. Unfortunately, even though the majority of the respondents own and have access to computers at home, 60% of teachers often have no access to classrooms with computers (Figure 5.9). Therefore the school principal could play a critical role in ensuring equal opportunity for less financially advantaged teachers and schools or motivate them with up-to-date technological advancement.

Changes in the demand pattern for food, clothing, household and personal equipment like computers can fluctuate due to high or low economic conditions. Income can be one of the main barriers to an individual for having his own computer access. A higher income would lead to a relatively greater increase in demand for goods compared to a lower income. Therefore, it is recommended that the government should play a significant role for less advantaged teachers by providing access to a wide range of elevated classroom learning experiences, including exposure to computer technology.

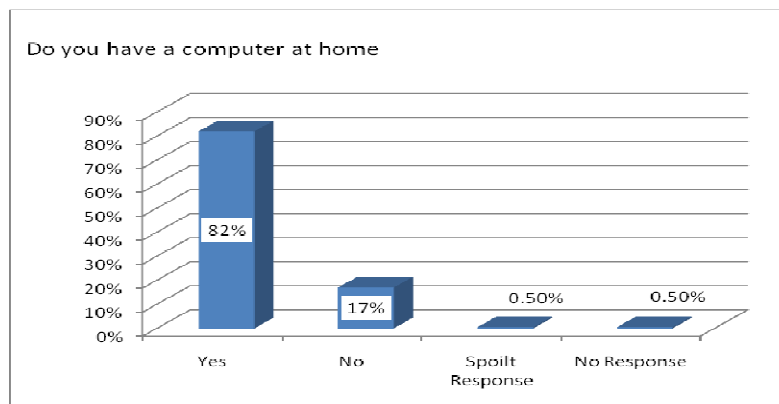


Figure 5.8: Access to computer at home

In Figure 5.9 the respondents that answered “where and how often they mostly have access to computer”, 63% of the population size stated that they do have access to computer facilities regularly at home, whilst 66% of the respondents stated that they have more access to computers from the school computer room than anywhere else. It could be stated that teachers spend most of their time using computer facilities at work due to the fact that most of the software they need to complete their work is located at school. This may also be due to the fact that the school has free usage of computers and internet services. Therefore, schools must struggle to keep on paying attention to the information and communication aspects with the rapid pace of technological and cultural change.

Respondents were asked how often they have access to computers in the computer room, classroom, office, Internet cafe and home. The study found 60% of respondents do not have access to computers in classrooms, 45% in office, 47% in Internet cafe, 23% at home and 16% in computer room. The majorities of the respondents do not have access in classroom but have access in computer room and at home. It could be acceptable if the majority of learners use computer access in computer room rather than teachers. It was regrettable to find such a high percentage (60%) of teachers who do not have access in classroom.

The use of computers in classrooms opens a new area of understanding for learners and offers a tool that has the potential to change some of the existing educational methods. As computer use continues to increase in societies, teachers must also prepare for the use of computers within the classroom. For computers to become an integral tool for learning, further improvements are needed in both the quantity and quality of computers available in classrooms. If quality and sound teaching and learning are to be achieved in schools teachers

and learners should not be excluded from having access to computers in offices and particularly in the classroom.

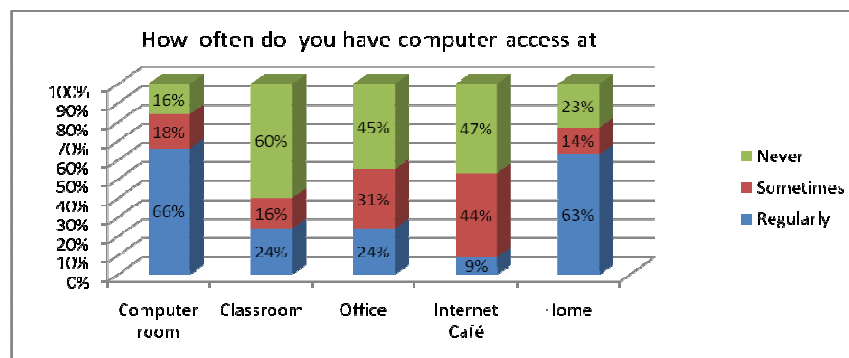


Figure 5.9: Access to computers at various places

A more detailed study, illustrated in Table 5.2 below, indicates that the majority of the respondents 49% agreed about having a sufficient number of computers available at school and 48% disagreed. A difference is only one percent. Although this is an almost equal distribution between those who have access to computers at school and those who do not have such access, 97% percent of teachers demand that computers should be used by schools more often than what they are currently provided with.

It was encouraging to note that respondents are able to realize the greater need to access computer equipment. The idea of increasing open hour access can be explored, and it may also be necessary to find out whether unrestricted teachers selfishly prevent other teachers from using computer resources and in doing so their access to instructional learning material may be restricted. Substantial progress is needed if schools have to play an effective role in ensuring extended time to promote equal opportunity for less advantaged teachers to access and use computers.

Rating		There is a sufficient number of computers available at my school		Computers should be used by schools more than they are now	
		Frequency	Percent	Frequency	Percent
Valid	Totally agree	68	22.7	263	87.7
	Partially agree	79	26.3	29	9.7
	Neither agree nor disagree	8	2.7	8	2.7
	Partially disagree	55	18.3	0	0
	Totally disagree	90	30.0	0	0
	Total	300	100.0	300	100.0

Table 5.2: Need to use number of computers and access to computers

5.5 WHAT COMPUTERS ARE USED FOR

Computers' usage can be seen in two ways: as ordinary and extra-ordinary use. By ordinary the researcher meant frequent use of computers for daily activities without the use of the Internet connection, whereas by extraordinary the frequent use of computers depend on having computers connected to the Internet.

5.5.1 Usage of Computers for Ordinary Tasks at Schools

As is tabulated in Table 5.3, teachers were asked the degree to which they use computers to prepare for and manage their learning and teaching aids. Fifty seven percent of public school teachers with access to computers in their classrooms or elsewhere indicated that they use computers regularly to create instructional materials, and 50% reported using computers regularly for administrative record keeping, 33% reported using computers regularly to communicate with parents or learners, 25% regularly use computers to access model lesson plans, 31% of teachers access research and best practices for

teaching, while 23% teachers stated that they use computers for multi-media classroom presentations. Less than 20% of teachers reported using computers to gather information for planning lessons, and to communicate with colleagues.

Experienced teachers were more likely to use computers to accomplish various teaching objectives in general than new teachers. Teachers with 3 or fewer years of teaching experience were less likely to use computers than teachers with 4 to 9 years of experience, while those with 4 to 9 years of teaching experience were less likely to use computers than teachers with 10 to 19 years of experience. This group reported using computers regularly to create instructional learning material, to manage administrative record keeping, to communicate with colleagues, parents, and students, to gather information for planning lessons, model lesson plans, to research and access best practices for teaching as well as multimedia classroom presentation. However, unlike teachers who had more experienced (4 to 9 and 10 to 19) newer teachers (55%) were more likely to use computers to accomplish various teaching objectives than teachers with 20 or more years (36%) of teaching experience. As teachers become older there tends to be an increase in the number and complexity of the necessary eye movements and focusing skills (eyestrain). Many of these symptoms can be reduced through computer approaches that help to reduce computer visual stress such as an ergonomic. It is the applied science of equipment design, as for the workplace, intended to maximize productivity by reducing operator fatigue and discomfort.

Teaching experience	Create Instructional learning material	Administrative record keeping	Communicate with colleagues	Communicate with parents or students	Gather information for planning lesson	Multi-media classroom presentations	Access research & best practices for teaching	Access model lesson plan
20 or more								
Regularly	9%	10%	3%	4%	2%	2%	3%	3%
Sometimes	3%	4%	4%	6%	7%	4%	5%	6%
Never	2%	0%	7%	4%	6%	8%	6%	6%
10 to 19								
Regularly	22%	20%	3%	12%	6%	6%	11%	6%
Sometimes	12%	17%	14%	19%	18%	11%	15%	17%
Never	4%	1%	21%	6%	13%	20%	12%	15%
4 to 9								
Regularly	15%	12%	3%	10%	2%	10%	8%	8%
Sometimes	12%	13%	13%	10%	11%	8%	8%	10%
Never	3%	5%	14%	10%	16%	12%	14%	11%
3 or fewer								
Regularly	11%	8%	3%	7%	4%	5%	9%	8%
Sometimes	6%	8%	6%	10%	7%	5%	6%	5%
Never	1%	2%	9%	2%	8%	9%	3%	5%
	100%	100%	100%	100%	100%	100%	100%	100%

Table 5.3: Usage of computer by teaching experience as ordinary task at schools

5.5.2 Usage of Computer as an Extra-ordinary Task at Schools

The Internet has become an increasingly valuable feature of the learning environment. The results showed that 76% (229 of 300) of teachers in public secondary school use the Internet. Besides that, when teachers are asked to focus specifically on the potential uses of Internet, as tabulated in Table 5.4, 72% of public school teachers with access to Internet in their classroom or elsewhere indicated that they use Internet for e-mail to communicate with colleagues, parents and

students; 64% for research purpose, 58% for games, 33% for Instant Messaging, 27% for chat, 15% for pornography, and 9% for fine arts.

Respondents age	E-mail		Fine arts		Instant mes-saging		Naughty web sites (porno-graphy)		Chat		Research		Game	
	Count	%	Count	%	Count	%	Count	%	Count	%	Count	%	Count	%
20 to 29														
Yes	52	17%	8	3%	27	9%	16	5%	29	10%	51	16%	39	13%
No	11	3%	52	17%	32	11%	45	15%	30	10%	12	4%	22	7%
I don't know	5	2%	8	3%	9	3%	7	2%	9	3%	5	2%	7	2%
30 to 39														
Yes	95	32%	13	4%	44	15%	16	5%	27	9%	81	27%	73	24%
No	29	10%	97	32%	75	25%	96	32%	90	30%	42	14%	51	17%
I don't know	5	2%	19	6%	10	3%	17	6%	10	3%	6	2%	5	2%
40 to 49														
Yes	47	16%	5	2%	22	7%	12	4%	23	8%	50	17%	45	15%
No	25	8%	65	22%	48	16%	58	20%	47	16%	22	7%	27	9%
I don't know	2	1%	4	1%	4	1%	4	1%	4	1%	2	1%	2	1%
50 to 59														
Yes	22	7%	1	0	5	2%	3	1%	1	0	11	4%	13	4%
No	4	1%	23	8%	19	6%	21	7%	23	8%	15	5%	13	4%
I don't know	0	0	2	1%	2	1%	2	1%	4	1%	0	0	0	0
60 or older														
Yes	0	0	0	0	0	0	0	0	0	0	0	0	3	2%
No	3	1%	3	1%	3	1%	3	1%	3	1%	3	1%	0	0
I don't know	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	300	100%	300	100%	300	100%	300	100%	300	100%	300	100%	300	100%

Table 5.4: Usage of Internet as extra-ordinary task at schools

The Internet truly revolutionized the way people communicate; e-mail has rapidly become the most adopted type of communication ever known. Most teachers use the Internet to access their electronic mail (72%). This potential role as an educational tool is often the primary reason why teachers get e-mail access. It helps teachers to communicate regularly with colleagues, parents, or students. However, sometimes even e-mail is not a fast enough from of instant messaging. In that case some teachers for faster delivery use Instant Messaging. Thirty three percent of teachers around the school send notes back and forth with learners not only from computers but also from their cell phones using instant messaging.

Table 5.4 above indicates that 58% of the respondents use a computer to play games daily. The respondents who indicated that they do not play computer games polled 37% and the respondents who do not know their status polled 5%.

Computer games are not only for entertaining people, but some, like flight simulator games, allow learners to experience being a pilot and to learn about the principles of flying (Wiley, 2005). Therefore, if computer games teach school-related skills directly or indirectly the educational value of the games they play could be tolerated. However, if 58% of teachers spend their time playing card games as entertainment rather than for educational purposes and school related-skills, the education department needs to implement policies to prevent the unwanted wasting of time. The wasting of productive time due to improper use of the Internet and e-mail can have a serious financial impact on the school (SnapshotSpy, 2008).

Free access to computer resources without restrictions to naughty websites and games at school can be a cause for teachers to misuse the resource and waste their time. Fifteen percent of teachers browse naughty websites like surfing for pornography. Although teachers are not under age, an enforcing law should be supported to ensure that teachers may not spend their precious times in browsing naughty websites.

Many schools have policies that specify which activities are allowed and which are forbidden. For instance, one school may allow the use of school computers to download software programs and another school may prohibit this. Some schools may allow access to collaborative online tools and some schools may not allow access to collaborative online tools, such as wikis, blogs, and Google docs, YouTube and Facebook (Aronson, 2008).

Respondents' computers at school are used both for academic and non-academic purposes. To indicate their views with regard to this statement, respondents were asked whether computers should be used for academic purposes only, as tabulated in Table 5.5. Twenty six percent of the respondents totally agree and twenty two percent partially agree regarding the consideration that computer resources at public high schools should not be used for non-academic purposes. Therefore, almost half of the respondents 48% leading by one percent against 47% of the respondents, agree that schools' computers should be for academic purposes only; and 5% neither agree nor disagree.

Rating		Computers should be used for academic purposes only			
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Totally agree	79	26.3	26.3	26.3
	Partially agree	66	22.0	22.0	48.3
	Neither agree nor disagree	15	5.0	5.0	53.3
	Partially disagree	62	20.7	20.7	74.0
	Totally disagree	76	25.3	25.3	99.3
	Spoilt Response	2	.7	.7	100.0
	Total	300	100.0	100.0	

Table 5.5: Usage of computer resources for academic purposes

5.6 COMPUTER EQUIPMENT USED BY TEACHERS

There are several types of computer equipment used by teachers at KZN public high schools. Respondents were asked how often they use the computer equipment in their daily task for facilitation of teaching and learning, and to select the items that they frequently use. From basic technologies, the respondents specified that among the different kinds of computer equipment regularly used, printers (57%), CD/DVD ROM (30%), and floppies or diskettes (29%), received the highest ranks.

The printer was ranked as the first most essential item for teaching and learning by 89% of respondents, 57% regularly and 32% sometimes. Teachers' description revealed that printers are seen important tool for printing handouts and test questions.

As indicated in Table 5.6 printers are listed as essential by KZN public secondary schools; if teachers have a scarcity of printers, or if printers are connected to one of the computers only, or if the printer is faulty and gives problems, technicians are required to ensure proficiency in this sector. The school may also elect to promote web-based distance education that provides some improvement over traditional paper-based education. Teachers can then present, submit or disseminate their work electronically, avoid delays in printing queues, and even save the cost of copying. Teachers can produce a running commentary in a soft copy format reducing the paper output and enriching the document by inserting audio-visuals, graphics, and other easily and accessible text documents.

CD-ROM and floppy disks are used as a means of transferring and storing data for a long time. Although they had played significant role for such a time, their use, especially floppy disks, as a means of storing or transferring information is drastically declining. The declining use of floppy disks by the respondents might be due to a number of reasons. One simple reason could be the small storage size, the second possible reason could be that they are quite susceptible to damage, and lastly that they are not as portable as USB flash drive.

From standard technology, respondents reported that among the different kinds of computer equipment regularly used, the USB flash drive (46%); laptop (16%) and overhead projector (10%) received the highest rank. In fact, the USB flash drive is more commonly used than the standard portable storages of CD-ROM (30%) and floppy or diskette (29%). USB flash drive has become increasingly popular over

the last decades and many important changes have also been seen during this time span. The use of new flexible and removable technologies like USB flash drive will benefit many teachers. USB flash drives are small, lightweight and portable storages. In recent times memory chips have become cheaper to manufacture so teachers can now benefit from large memory capacities at lower prices.

How often do you use the computer equipment listed below for teaching and learning in the classroom?		Regular		Sometimes		Never	
		Frequency	percent	Frequency	percent	Frequency	percent
Basic Technology	a) Floppy disk	86	28.7	115	38.3	99	33
	b) Printer	171	57	96	32	33	11
	c) CD/DVD ROM	91	30.3	143	47.7	66	22
	d) Scanner	16	5.3	109	36.3	175	58.3
Standard Technology	e) Overhead Projector	29	9.7	90	30	181	60.3
	f) USB flash drive	137	45.7	91	30.3	72	24
	g) Digital camera	19	6.3	83	27.7	194	64.7
	h) Webcam (Web camera)	10	3.3	30	10	260	86.7
	i) Laptop (Notebook Computer)	49	16.3	66	22	185	61.7
Advanced Technology	j) Digital Whiteboard/ Interactive Smart Board	31	10.3	23	7.7	246	82
	k) Smart phones and PDAs	28	9.3	55	18.3	217	72.3
	l) GPS (Global Positioning System)	5	1.7	16	5.3	279	93
	m) iPod	10	3.3	49	16.3	241	80.3
	n) Games machine like PlayStation 3 and XBOX	9	3	53	17.7	238	79.3

Table 5.6: Computer equipment used for teaching and learning facilities

From the advanced technology, respondents reported their regular usage of a digital whiteboard or interactive whiteboard (10%) and smart phones and PDAs (9%). Thirty one out of three hundred against thirty out of three hundred specified that the interactive whiteboard is more commonly used than the overhead projector. Teachers considered the interactive whiteboard as much simpler to use and efficient to get students' attention. Teachers using new technology are a good sign in moving forward to successfully utilize technology within the diverse classroom settings.

5.7 COMPUTER EQUIPMENT USAGE FREQUENCY

The bar graph below represents computer usages in terms of days either at work or at home. As shown in Figure 5.10 respondents were requested to indicate their frequency of computer equipment use in terms of days to facilitate their learning materials. Out of 300 respondents the research found that 45% of respondents use a computer every day and 38% use computers at home, work or elsewhere several times a week. Only 5% of this group reported that they use the computer equipment at school home or elsewhere once a week, against 5% once every two weeks, 2% once a month, while 5% rarely use the computer equipment at schools or elsewhere.

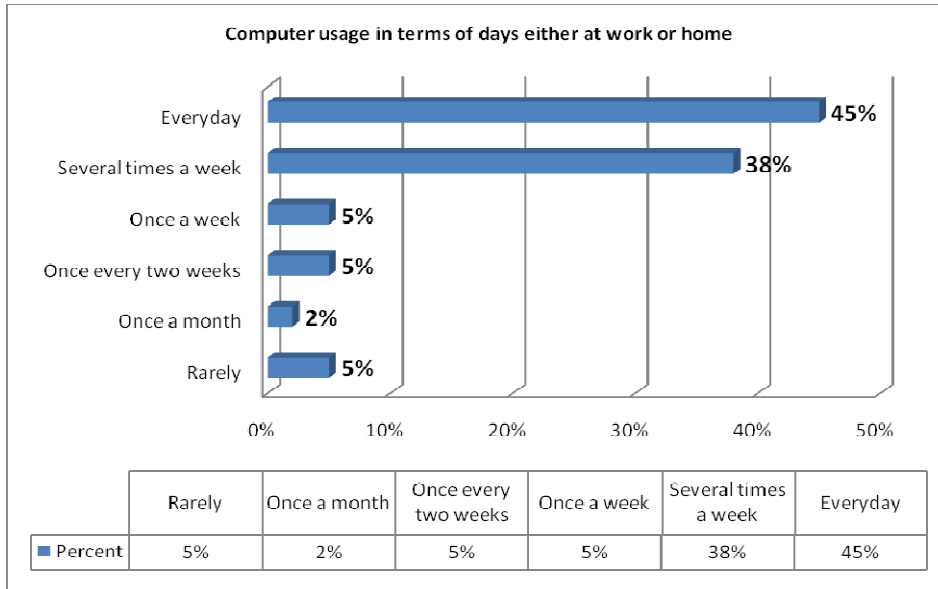


Figure 5.10: Computer usage in terms of days either at work or home

In Figure 5.11 respondents were asked if they use computers frequently for their daily task in terms of hours, either at work or home. Six percent of the respondents indicated 8 hours or more at a time, 27% 4 to 7 hours at a time, 56% 1 to 3 hours at a time, 10% less than an hour at a time to create instructional material, administrative record keeping or to access research for best practices and manage model lesson plans per day. The rest (1%) of the respondent do not ever use a computer. On average the respondents spend more than three hours at computers.

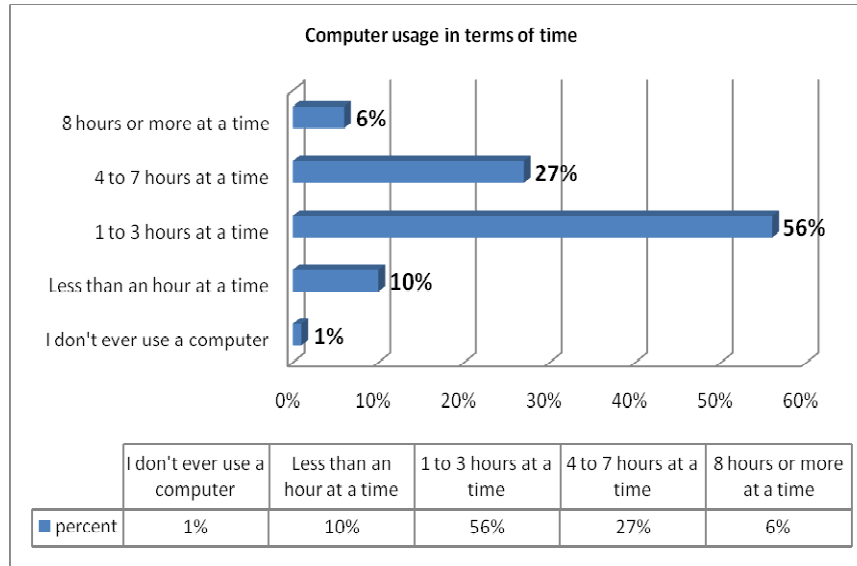


Figure 5.11: Computer usage in terms of hours either at work or home

It is clear from the analysis that most teachers use computers between 1 to 7 hours per day. When a more detailed analysis is done the following data are obtained (See Figure 5.12). Teachers whose age falls from 20 to 29 are the long-hour users and teachers whose age falls from 30 to 39, are next in line.

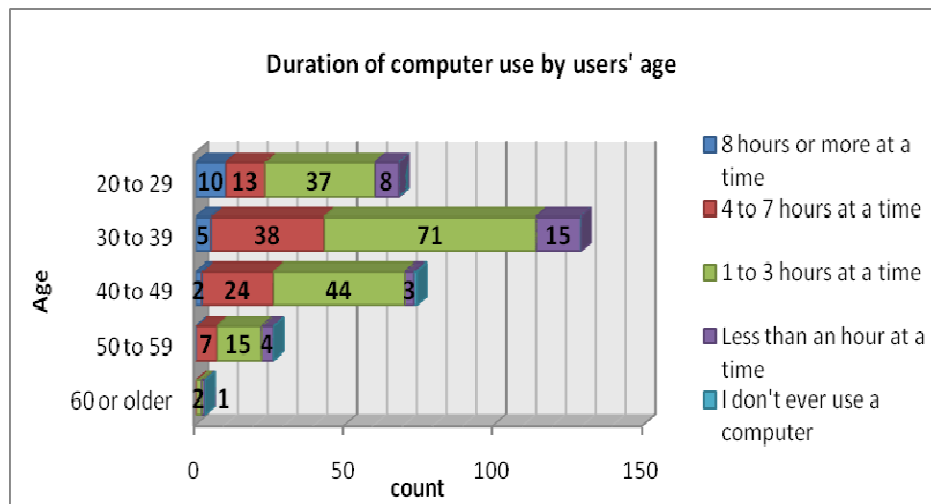


Figure 5.12: Duration of computer use by user's age

5.8 READINESS FOR EFFECTIVE USE

The South African government has taken a laudable step by introducing computer education, since Curriculum 2005 aspires to make computer an essential part of the education system in the country (Curriculum, 2005). Although a lot of resources have been poured into IT in education planning in public high schools, it is necessary to conduct a survey for readiness assessment before any e-Learning program is actually launched. It is important to know the factors affecting teachers' computer use and its implications teachers' professional development strategies. In this regard two aspects of the approach are particularly important: firstly, readiness for self-assessment and secondly, readiness for e-Learning.

5.8.1 Readiness for Self-assessment

Teachers need to know and evaluate themselves before they interact with equipment that requires skills. Knowledge requires understanding of how computers could contribute efficiently in education. The more knowledge teachers have the more likely they will succeed. Based on readiness for self-assessment respondents were asked to rate their level of skills. Figure 5.13 shows, out of 300 respondents 22% of teachers have advanced computer skills, 46% of teachers have intermediate skills, 30% of teachers have basic computer skills, and the rest (2%) of teachers have no computer skills. The majority of teachers have more than just basic skills. Despite this positive outcome, 30% of teachers have basic computer skills and 2% have no computer skills at all.

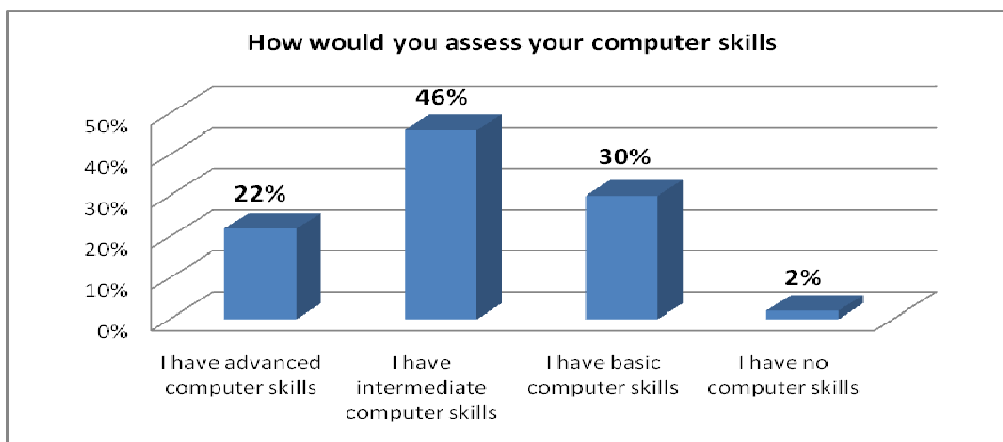


Figure 5.13: Readiness for self-assessment

Table 5.7 tabulates two set of questions: most of the respondents (97%) agreed on the first part of the sets of questions that says “all teachers should learn how to use computers”. Thus, teachers should be given a computer skills literacy course or workshops to continuously update them with the fast growing computer technology and in order to make them appreciate the ways computers and societies have changed each other.

The reply of respondents to the second sets of questions: “Are the teachers given opportunities to learn to integrate computers in their classroom practices?”, 69% percent answered the question negatively and 11% percent was not sure about learning opportunities provided by the school.

All teachers should learn how to use computers	Percent	Are the teachers given opportunities to learn to integrate computers in their classroom practices?	Percent
Totally agree	91	Yes	20
Partially agree	6	No	69
Neither agree nor disagree	0	I don't know	11
Partially disagree	0	Spoilt response	0
Totally disagree	3	No response	0

Table 5.7: Need for computer literacy.

One may point out from these findings that there is clearly and urgent need for ongoing training regarding fundamental knowledge, skills and values that give teachers opportunities to learn and integrate IT skills into their work environment. Some of the teachers provided comments at the end of the questionnaire as to why computer skills are important by saying: “skills are valuable tool to improve the quality of education; all teachers need more advanced computer system and more profound computer knowledge”.

As tabulated in Table 5.8 below more detailed information was gained regarding computer skills. One hundred respondents were tested using direct observation with regard to initially identified computer skills by being given three different practical formats of questions to which they assigned their knowledge of skills as basic (30), intermediate (42) and advanced (28).

Thirty teachers were asked three practical format questions to which they assigned their knowledge of skills as basic. Thirty out of thirty (100%) of teachers knew how to turn the computer on and off, whilst 40% of teachers totally failed to show how to save the file called “sample” on the desktop in the sample document folder. Again the same number of respondents (40%) succeeded in saving the file called “sample document” on the desktop in the sample document folder. The rest (16%), with a bit of assistance, managed to save the file called “sample document” in the sample folder on the desktop. One percent of teachers clicked into the “save file” icon on menu bar, yet they did not know where they have saved the file called “sample”.

Task to perform		Bad	Not bad	Good	Very good	Excellent
Basic Assessment	a) Please turn on the computer.	0	0	0	0	30
	b) Please show me how you save the document called <i>Sample Document</i> on the desktop in the <i>Sample document Folder</i> on the USB flash drive.	12	2	4	6	6
	c) Please turn off the computer	0	0	0	0	30
Standard Assessment	d) Please open and close the software program that you use to record learners' tests and assignment scores.	0	1	1	2	38
	e) Please show me in MS Word what you will do to print only pages 1 and 3 of the document.	0	4	5	9	24
	f) Please show me in MS Word what you would do to insert a table of contents in a document.	22	1	1	1	17
Advanced Assessment	g) Please write one paragraph on how you could spend your weekend and when you finish run the spell check.	0	0	2	1	25
	h) Please show me how you would import a document from MS Word to MS Excel.	4	3	3	4	14
	i) Please show me how you would capture an image of your computer screen by using the keyboard only.	7	0	1	0	20

Table 5.8: Respondents' practical assessment

Forty-two teachers were asked three practical format questions to which they have assigned their knowledge of skills as standard. Forty out of forty two (95%) of teachers knew how to open and close the software program that they used to record learners' tests and assignment scores, 74% knew how to print certain requested specific pages,

43% also knew what they should do to insert a table of contents in a document.

Whilst 2% of teachers with a bit of assistance managed to open and close the software program that they use to record learner's tests and assignment scores, 12% with a bit of assistance managed to demonstrate what they would do to print specific requested pages (page 1 and 3) of the document and 2% with a bit of assistance managed to insert a table of contents in a document.

The rest (2%) of the teachers, even with a bit of assistance, failed to open and close the software program they use to record learners' tests and assignment records, 10% teachers with a bit of assistance failed to demonstrate how to print only pages 1 to 3 of the document and twenty three out of forty two (55%) with a bit of assistance failed totally to insert a table of contents in a MS Word document.

Twenty-eight teachers were asked three practical format questions to which they have assigned their knowledge of skill as advanced. Twenty six out twenty eight (93%) of teachers knew how to write one paragraph on how they could spend their weekend, and when they finished, to run the spell check, 60% how they could import a document from MS Word to MS Excel, 71% also knew how they should capture an image of their computer screen by using the keyboard.

Whilst 7% of teachers with a bit of assistance managed to write one paragraph on how they could spend their weekend, and when they finished, to run the spell check, 11% of teachers with a bit of assistance managed to show how they could import a document from MS Word to MS Excel and 4% of teachers with a bit of assistance managed to capture an image of their computer screen by using the keyboard.

The rest (25%) of teachers, even with a bit of assistance, failed to demonstrate how they could import a document from MS Word to MS Excel and how to capture an image of their computer screen by using the keyboard.

5.8.2 Readiness for e-Learning

After dealing with self-assessment or self-readiness of the teachers for how ready they are, it was necessary to examine the factors and constructs identified to assess e-Learning based on technology. Technology implies access to computers and Internet.

To find out whether teachers are equipped with the right technology and ready for implementing e-Learning for effective use of teaching, they were requested to answer how well they are prepared for e-Learning. As described in Figure 5.14, the histogram chart below, taken as a whole 49% of teachers are ready for e-Learning, and 21% of teachers are somewhat prepared, although they need some level of skills. Based on this result it can be inferred that teachers in KZN still need to be trained to use ICT in education. How likely students are to experience computers in academically powerful ways depends significantly on their teacher's expertise with computer.

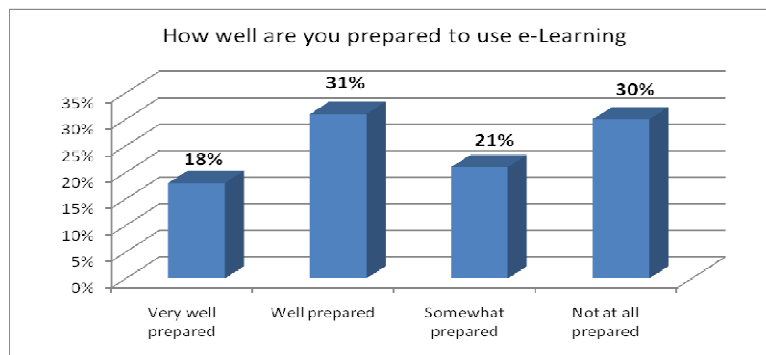


Figure 5.14: Readiness for e-Learning

A further study was made to investigate the availability of learning resources and support services for learners and teachers in implementing remote education programs. As depicted in Figure 5.15, the majority of public high schools (55%) acquired an internet connection, e-mail accounts (55%), and have teachers who teach computer studies at schools (64%). However the larger number of KZN secondary schools have not yet introduced to Computer Assisted Instruction (CAI) (76%) as well as distance learning (remote education) (80%).

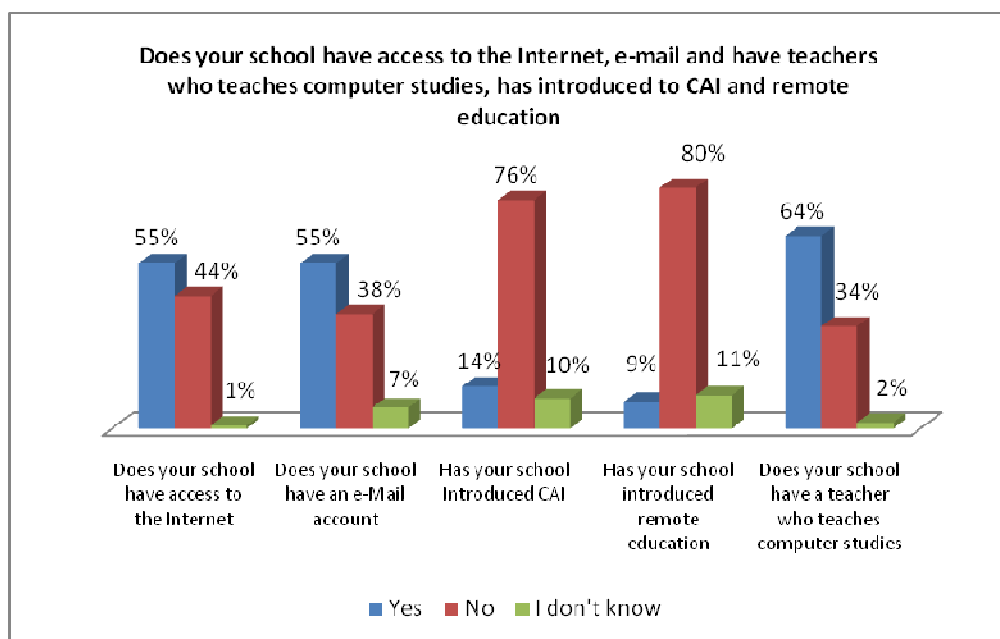


Figure 5.15: Does your school have the following things?

The Internet is already having a significant impact on education with new technologies to provide a vast range of e-Learning materials accessible via the World Wide Web. Though a laudable number of schools have a connection to the Internet (55%), e-mail accounts (55%) and teachers who teach computer studies at school (64%), there is still a lot advancement needs to be done in uplifting of schools with what they do not have and what they do not know. There are quite high numbers of schools do not have Internet connection (45%), Com-

puter Assisted Instruction (86%) and e-Learning implementation (91%) to meet the demands of e-Learning.

Most schools acquire access to the Internet to enable them to use technology as integral learning tools. As a result, most schools will continue to be technologically advantaged in acceleration the professional development of educators through such distance education modes as e-Learning. However, even though 55% of the schools have Internet access, the system seems slow primarily when they are connected to the Internet speed. The reason for this might be the broadband connectivity of schools needs to be upgraded in respect of cost-effective throughput and affordable download speeds. Table 5.9 shows that only 26% of the respondents admit the school computers are fast to download information from Internet, while 67% of the respondent describes the school computers are slow to download information from the Internet. The rest (30%) of respondents do not practice downloading. Those schools that have low transmission speeds need to upgrade the connectivity of network to the potential and ability to deliver true broadband speeds in helping to make the vision of pervasive connectivity a reality in the modern high technology age.

The Table below reveals that there is a lot that needs to be done for the schools to be equipped with fast technology in order to be ready for the introduction of e-Education in 2013 in KwaZulu-Natal.

Rate	Frequency	Percent	Valid Percent	Cumulative Percent
Valid I don't do this	91	30.3	30.3	30.3
Very fast	15	5.0	5.0	35.3
Fast	63	21.0	21.0	56.3
Average time	64	21.3	21.3	77.7
Quite slowly	38	12.7	12.7	90.3
Very slowly	29	9.7	9.7	100.0
Total	300	100.0	100.0	

Table 5.9: How long does it take to download information?

As can be seen from Figure 5-16, 43% of schools have their own websites while the majority 57% percent of schools in KwaZulu-Natal, do not have their own websites. School websites help novice students who do not know about the school's academic rules, instructions, and guidelines to find out what would best suit their qualifications and requests or any other information they need. Regrettably, only 43% schools have their own website. Of those schools that have website 14% of the respondents (6 out of 43) judged that their school's website was very well designed while 37% of the respondents (16 out of 43) judged that their school's website was well designed, the rest 28% of the respondent (12 out of 43) though that their school's website was neither poor nor well and 21% percent of the respondents (9 out of 43) thought that their school's website was poorly designed. Totally of those schools that have website 51% are well designed.

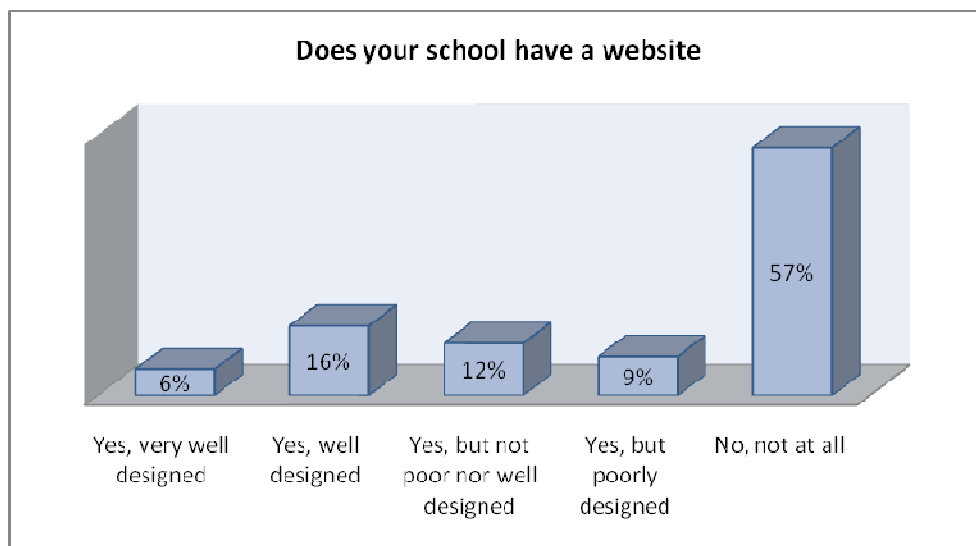


Figure 5.16: Does your school have a website?

If all schools could have their own school websites, it should be easy to clearly identify their purpose for their schools through their websites. Schools could then come up with exciting possibilities for collaborative online tools, up-to-date and accurate information to-

wards their user, and staff, students or parents will benefit from its resource.

5.9 SCHOOL COMPUTER SOFTWARE AND HOW THEY ARE USED

Figure 5.17 below illustrates that the vast majority of teachers regularly use MS Word (94%) and almost three quarters of teachers regularly use MS Excel (74%). Forty percent of teachers regularly use MS PowerPoint (40%) to display learning discussions to learners. From teachers' perspective MS PowerPoint was supposed to be used extensively to display learning materials in a slide show manner along with projector machine or an interactive whiteboard. However, as mentioned in Table 5.6 previously, 54 out of 300 (18%) specified that they use the interactive whiteboard more commonly than the overhead projector. To be effective MS PowerPoint can only be used with an interaction of computers if they are intended to be explained to listeners. According this findings 22 out 40 (55%) are projector or overhead projector users than an interactive whiteboard users. Interestingly, this result exactly match with the result found in Table 5.6 that indicates 54 respondents of interactive whiteboard users against 119 overhead project users (45% versus 55%). Finally, other Microsoft suit software such as MS Access and MS Outlook are used to a lesser extent.

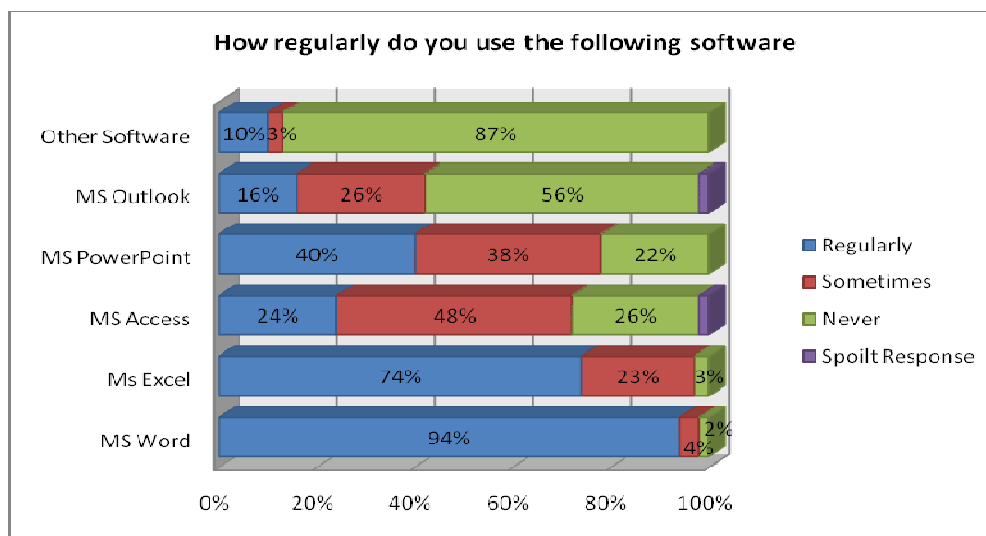


Figure 5.17: How regularly do you use the following software?

5.10 SCHOOL COMPUTER HARDWARE AND HOW THEY ARE USED

To assess the school computer hardware and how they are used, three sets of questions were included in the questionnaire. The given response is summarized in Table 5.10. In the first set of questions the study reveals that, 61% of respondents believe that the school computer equipment is not up-to-date.

In the second set of questions 53% of the respondents on the other hand believe that the emerging or new technologies are user friendly. As the majority of respondents rated the emerging technologies as manageable and user friendly, it seems that schools are happy with migrating to new equipment. The rest 76% of the respondents do not agree on the statement that says: “computers are of little value in classroom”. In fact 57% of teachers strongly disagree that computers are of little value in the classroom. The need for the schools to reconsider the use of up-to-date and user friendly computer hardware to satisfy the needs of its teachers, is obvious judging from this response.

Rating	The school computer equipment are not up-to-date	Emerging/new technologies are user friendly	Computers are little value in classroom
Totally agree	34%	33%	6%
Partially agree	27%	20%	6%
Neither agree nor disagree	5%	25%	12%
Partially disagree	17%	7%	19%
Totally disagree	16%	15%	57%

Table 5.10: School computer hardware and how they are used

5.11 COMPETENT ENTITIES OF SCHOOLS (PRINCIPALS AND MINISTRIES OF EDUCATION)

Principals and ministries of education are the two leaders and linchpins in the enormously complex working environment at schools.

5.11.1 Principals

The role of the principal is a key factor in promoting or inhibiting change. Principals as teachers, leaders and authority persons have an important role in shaping and overseeing teachers and learners. Principals are in the position to run their schools with relatively more effective way of leading. The discouragement felt by respondents in attempting to cope with technology is aptly described in the following phrase: “Principals do not understand the potential contribution of computer technology”. As shown in Figure 5.18, 65% percent agreed that principals do not understand the potential contribution of computer technology.

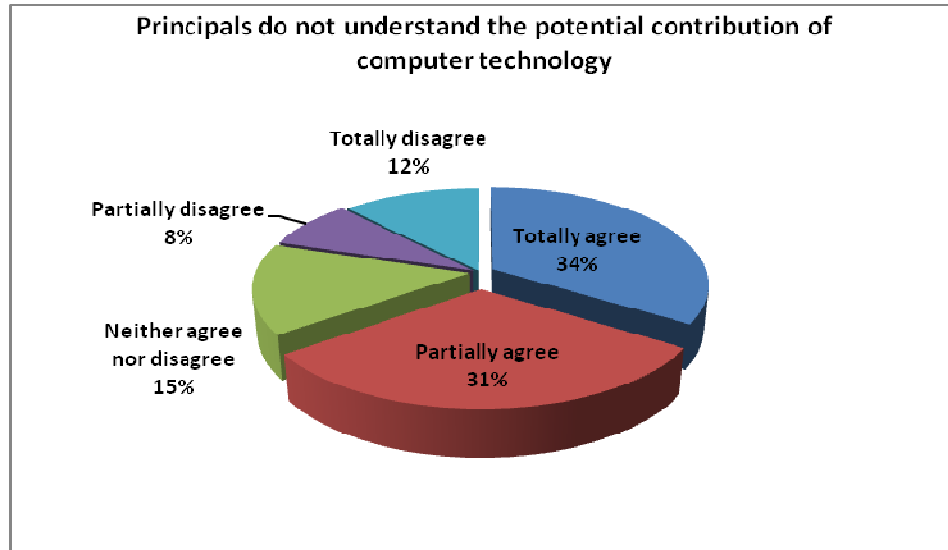


Figure 5.18: Understanding of principals of the potential contribution of computer technology

The principals are the kinds of persons who are supposed to be sharing the lead and sharing the load. Obviously, principals also need autonomy and support to lead the school effectively. The need for autonomy may require supervisors to treat each principal differently; the need for support may require supervisors to be sensitive to each principal's view of what he or she finds meaningful or trivial about his/her work.

Based on the study (Figure 5-18), principals are seen as managers who show little understanding of the potential contribution of computer technology to teaching and learning in the schools.

In conclusion, though the teachers are unhappy towards the principals, it is difficult to bring to a close by pointing fingers against the principals without given them chance to be heard. Therefore, in a future study an involvement of principals would contribute a concrete and solid idea of this study.

5.11.2 Ministry of Education

As with the role of principals, the role of the ministry of education is also a key factor in creating optimal teaching systems. Seventy one percent of the respondent disagreed saying that the ministry of education does not understand the potential contribution of computer technology in improving of the quality of education in high schools. The rest (17%) of the respondents agreed that the ministry of education understands the potential contribution of computer technology (See Figure 5.19).

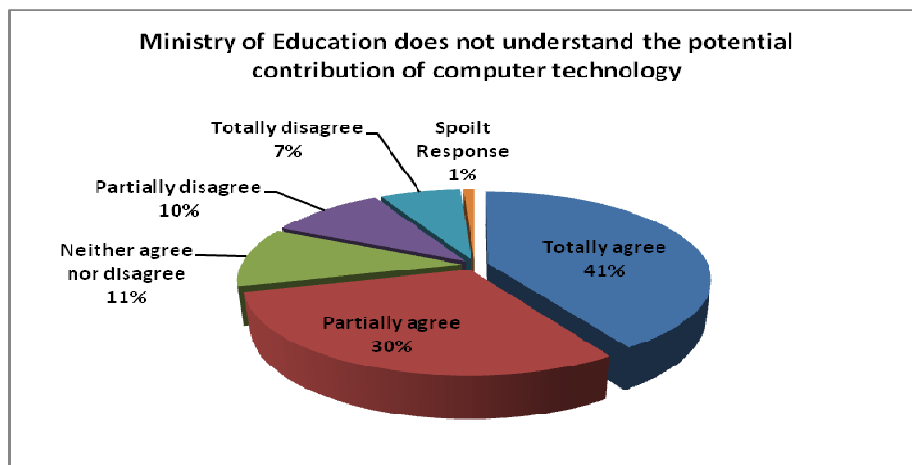


Figure 5.19: Understanding of the ministry of education on the potential contribution of computer technology

The same can be applied to the ministry of education as to the principals. Although the teachers are unhappy towards the ministry of education; the intervention of the ministry of education is very demanding on saying: “the ministry of education should try to understand the potential contribution of computer technology and integrate technology applications in KwaZulu-Natal public secondary schools so that teachers have opportunities to acquire technical skills and have valuable equipment to enhance their teaching style”.

5.12 CONCLUSION

In this chapter the researcher presented the results of an empirical study of how public secondary school teachers in urban and rural communities of KwaZulu-Natal effectively and efficiently use computers and emerging technologies in adopting e-Education.

The notion that the benefit of computers in improving the quality of education should be used by the schools more than they are currently provided at public schools of KZN was supported by 97% of the respondents. This urges schools to provide access to teachers to work for more extension of time than currently being provided.

Another report of study as depicted in Figure 5.9 states 66% of teachers access their computer more often from school computer rooms and 82% of teachers access computers at home than anywhere else such as classroom, office and Internet cafe. Yet 60% of teachers did not have access to computers in the classroom and 45% in the office. Although, it is good to find such high number of teachers have their own computer, the rest of the access areas have also to be elevated for effective delivering of e-Learning.

Unfortunately, a high number of respondents (48%) disagreed about having a sufficient number of computers available at school and computers provided are too few to satisfy their needs. The analysis showed that 61% of respondents believe that the school computer equipment is not up-to-date; 53% of the respondents on the other hand believe that the emerging or new technologies are user friendly, and 76% disagree on the statement that says “computers are of little value in classrooms”. As the findings of the result make known, it is clear that schools should get maintenance of the existing problems if they are needed for contributing to better academic performances or effective uses.

The respondents use the computer resources at schools both for academic and non-academic purposes (such as creating instructional learning materials, administrative record keeping, communication with colleagues, parents and students, gathering information for planning lessons, multimedia classroom presentations, access to researches, e-mail, fine arts, instant messaging, naughty websites (pornography) chat, and games. Forty eight percent of respondents agree that computers should be used for academic purposes only, 5% of respondents neither agree nor disagree and the rest (47%) disagreed on the need for regulations that enhance only the academic use of computer resources. This is a discouraging revelation. Computers that are used for games and access to pornography should not be available to teachers and learners in an academic setting.

Ninety seven percent of the respondents agreed that all teachers should learn computer skills. Sixty nine percent of respondents revealed that teachers were not given opportunities to learn to integrate computers in their classrooms and 11% of respondents were not sure about learning opportunities. This study has demonstrated clearly that most teachers in KZN need training or should be equipped with the necessary skill to ensure successful implementation of computer education programs.

The respondents specified that among the different computer equipment of use are: printer (89%), CD/DVD ROM (78%), USB flash drive (76%), floppy disk (67%), overhead projector (59%), scanner (42%), digital camera (34%), laptop (38%), PlayStation 3 (21%), iPod (20%), interactive whiteboard (18%), webcam (13%) and GPS (7%). The most commonly used equipment are printers, USB flash drives and interactive whiteboards (smart board) as basic, standard and advanced equipment respectively. The printer was ranked as the first most essential item (89%). Sixty one percent of the respondents believe that their school's computers are not up-to-date and 57% of

teachers strongly disagree that computers have little value in classrooms. Out of the respondents 53% mentioned that emerging or new technologies are user friendly.

The majority of public high schools (55%) acquired an internet connection, e-mail accounts (55%) and have teachers who teach computer studies at school (64%). However, as opposed to that the majority of KZN high schools have not yet introduced Computer Assisted Instruction (CAI) (76%) as well as distance learning (remote education) (80%). Sixty five percent of the respondents stated that the principals do not understand the potential contribution of computer technology and 71% of the respondents stated that the ministry of education does not understand the potential contribution of computer technology either. The role of principals and the role of the ministry of education are key factors in creating an optimal teaching system.

The recommendations and conclusions about what needs to be done before the successful implementation of e-Education in urban and rural communities of KwaZulu-Natal public secondary schools can take place, and what practical strategies need to be implemented to overcome obstacles, drawn from the findings of this chapter, are given in a summarized form in the following chapter.

Chapter 6

CONCLUSION OF FINDINGS OF THE RESEARCH AND DISCUSSIONS

6.1 INTRODUCTION

In this chapter the researcher will provide a summary of the main conclusion reached in the analysis and discussions chapter (Chapter 5) as well as evaluate the strength and weakness of the study. Furthermore, the researcher will present answers to critical questions that prompted this study and are mentioned in the first chapter. These answers are based on the theoretical framework of this study and reveal whether the researcher has managed to address the critical questions that provoked this study.

Conclusions are the main points that are elicited through analysis of the data and are presented among the comparisons in the previous chapter. These conclusions can be about a single concept, the interesting findings seen or about a combination of issues that are found to be related.

The researcher will also demonstrate critical questions that could not be addressed by the study and state limitations that contributed to this shortcoming. Finally, the research will conclude with areas for further research and recommendations.

6.2 GENERAL IDEA ABOUT THE THESIS

In this section of the thesis, the researcher will draw an overview of the research problem, how the literature survey was conducted and a synthesis of the theoretical framework and characterization of the research methodology and data analysis.

6.2.1 Research Problem

In attempting to provide an overview of this dissertation by integrating findings and recommendations emanating from this study, it is essential to summarize and review the research in order to determine to what extent the empirical results answered the research questions. This study was prompted by South African White Paper on e-Education (2004) whereby the South African Department of Education states its intention to expand new learning opportunities and access to advanced ICT for e-Education beyond those in the traditional learning environment by 2013.

Against this background, the researcher conducted a quantitative research to investigate the effective use of computers and emerging technologies for e-Education in public secondary schools. The study mainly focused on teachers in urban and rural communities of Kwa-Zulu-Natal and it aimed on transforming these teachers in adopting ICTs on access, cost effectiveness and quality of education in the learning and teaching environment in education.

6.2.2 Literature Survey

The study entailed the literature survey to determine which aspects of the research problem have been researched elsewhere and how applicable the solutions of such research are for e-Education in South Africa. The research survey further involved the use of electronic reference sources of UKZN namely SUBNET, NEXUS and EBISCO-HOST.

6.2.3 Empirical Research

The literature survey was followed by an empirical investigation presenting an account of the research methodology that was employed

to conduct the quantitative research approach. This involved a structured questionnaire-based survey of the sample of educators from urban and rural communities of KwaZulu-Natal. The researcher got data that informs how many teachers and public schools are in KwaZulu-Natal from the KZN Education Management Information (EMIS) unit. The researcher used this information to ensure that the research targeted a valid representative sample of the population. He also obtained permission from the KZN Department of Education to conduct the survey among educators from various schools who attended a computer training workshop at a designated school in Durban. The researcher's supervisor was requested to write a letter to the KZN Department of Education requesting research access on behalf of the researcher.

6.2.4 Data Analysis

The researcher used the statistics program SPSS 15 and Microsoft Office Excel 2007 to analyse data and to compile tables and graphs.

6.3 SUMMARY OF WORK COMPLETED

There are many of recommendations to be made based on the entire study. The final recommendations of the author in terms of the major findings of the study are indicated in the following sub-sections:

6.3.1 CAT (Computer Training Skills)

Computer Applications Technology is the effective use of Information and Communication Technologies in an end-user computer applications environment in different sectors of society. It equips learners with knowledge, skills, values and attitudes to create, design and communicate information in different formats. It also makes it possible for learners to collect, analyse and edit data and to manipulate,

process, present and communicate information to different sectors of society (DoE, 2004). Many teachers in KZN requested Computer Application Technology (CAT) to develop the skills and knowledge necessary for teachers to effectively use ICT as an instructional tool.

The ministry of the Department of Education must prioritize CAT Computer studies as it is demanded by teachers. All teachers and other educators are key contributors to the transformation of education in South Africa.

6.3.2 Internet Access

The results discovered that although many KZN public secondary schools 55% are connected to the Internet, yet 45% are not connected to the Internet (Figure 5.15). Of those schools about 60% of the respondent do not have access to computer in the classroom and 45% (Figure 5.9) still do not have access to computer in the office. Access to computer and Internet should be supplied and paid for by the Department of Education.

If e-Learning will be introduced as an integral part of teaching and learning environment by 2013 an Internet connection is an essential part in transforming high quality, relevant and diverse resources beyond what current schools are providing. e-Learning refers more specifically to the context of using the Internet and associated web-based applications as the delivery medium for the learning experience (White Paper on e-Education, 2003).

Obviously, there is a need for further access to computers and Internet connection so that teachers can perform basic tasks for their study and learning facilities. The learning process can only speed up if teachers have computers and access to the Internet and schools have well managed and organized IT resources. Without Internet access teachers would not be effective in their work as commented on by some of the teachers: "We have several educational programs provided

by Eskom and the Department of Education (viz. Encarta, Lesmaths and career guidance) but do not have Internet connections. The internet has become an important part of our everyday lives that many teachers now regularly use it to access information, for email communications and to complete transactions. Teachers are so dependent on the Internet; this is the 21st century, without Internet connection it is impossible to go forward.”

Generally to conclude about the Internet access, 45% of schools do not have Internet accesses and that could prolong the implementation of collaborative online tools, empowering learners and teachers with 21st century skills. There is a strong recommendation from teachers for free and open access to all possible technology tools.

6.3.3 Funds

Several teachers demanded that their schools be funded by the ministry of the Department of Education for professional development and that the effective integration of technology into the curriculum and instruction be documented. This is an obvious appeal from teachers as commented at the end of the questionnaire: “We would strongly advice that you forward your study to Department of Education (DOE) to get funding for us as IT will be a dead subject if there is no money”.

In 2003 the government of South Africa published, the White Paper on e-Education stipulating that all South African secondary schools should operate as electronically managed schools by 2013. Therefore, the government will have to speed up the expansion of ICT infrastructure at affordable cost to enhance the effective use of ICT in education. There are only four years left for the proposed e-Learning implementation.

6.3.4 Security

Computer security can grant teachers and learners the knowledge needed to be secure from unwanted users and disgruntled learners or from purposeful theft and fraud. As some teachers commented at the end of their questionnaire, they truly need some security systems to prevent learners from purposefully stealing and breaking computer parts. Security is not part of the researcher's major study; however, if a security system is not implemented in schools, they will not be able to make effective use of computers. Therefore, though some schools do not have advanced and computerized security, it is recommended that computer localities should at least be fenced and have a security guard who is at the gate seven days per week and 24 hours per day.

6.3.5 Technicians

As the result depicts In Figure 5.17, sixty one percent of respondents consider that the school computer equipment is not up-to-date. Based on the findings and results schools need technicians who follow up faulty equipment. Most of the ICT competencies require continuous updating because of the rapid rate of technological development. As commented by a respondent: "We have a computer room with 30 old computers but no computer technician or a LAN administrator to look after our equipment." Schools require LAN administrator that monitors faulty computers and peripherals. In addition to that computers can be misused by users and may need urgent maintenance. As Gahala (2001) states, without technical support most teachers will end up with equipment failure, software complexity, data loss, embarrassments, and frustration. Teachers do not want to be in a position were learners wonder why the equipment is not working the way it is supposed to.

Not only hardware problems need to be monitored, but software installations as well. Therefore, it is greatly recommended by the teacher that the ministry of education in connection with some business entities should assist those poor schools by donating what basics they need to be productive and worthwhile with their time.

6.3.6 Websites

As mentioned in Figure 5.16, fifty seven percent of the respondents in public schools do not have websites. Having school websites could give learners and teachers significant advantages. Some of these are:

- 1) It will give a competitive advantage and will be an effective of means of information communication for learners and teachers.
- 2) It will enhance credibility because if learners and teachers hear about an organization the first thing they would want to find it on the Internet.
- 3) It will enhance communication with other learners, teachers and schools around the globe.
- 4) School websites deliver innovative development by reforming and organizing important classroom activities. It is a great way to share and exchange knowledge (Simms, 2005).

Therefore, schools should be encouraged to design their own websites. By having their own websites they can advertise their method of teaching and services without huge cost, delays in printing, publishing and distribution. Teachers are interested in technology, but need increased opportunities to develop their capacities. Only 49% of teachers considered themselves well prepared to use e-Learning in their classroom.

6.4 SUMMARIZED ANSWERS FOR THE RESEARCH QUESTIONS

All the research questions discussed here are based on the previous chapter (Findings of the research and discussion). Brief answers to these questions are as follows:

6.4.1 What is the level of knowledge that teachers need to have to be able to use emerging and existing technologies?

The use of computer technology generally requires basic of technical knowledge. Just as someone learns to drive a car without knowing in details about the internal components of the car (engine), someone can learn to use a computer without understanding much the technical details of how a computer works. However, more knowledge gives one a great advantage. Knowing more about cars can help one to make a wise purchase and save money on repairs. Likewise, knowing more about computers can help one buy the right one for one's needs, and have a much higher level of comfort and confidence as a result.

Results from the survey reveal that 98% of educators teaching in public secondary schools in urban and rural communities of KZN have computer skills identified as basic (30%), intermediate (46%) and advanced (22%). Though the outcome is encouraging, there is a need for the uplifting of the 46% of intermediate teachers to advanced skills and 30% of basic teachers to intermediate skills.

As this study investigated, training will be necessary for all public high school teachers and especially for novice teachers who do not know how to use the computer efficiently and effectively. The competent authority of the school needs to bring in more educators who are computer literate and equip all educators with computer skills and sufficient supplies of computers in their schools. Schools require hav-

ing a teacher that is highly computer literate so that all the learners can leave the school with deep-rooted computer skills.

Educators also encounter problems in Microsoft Word and Microsoft Excel as they have not been exposed to other information systems that are available to them on the computer. Some of the teachers are also challenged with equipment training skills, as one of the teachers commented saying “We have a computer projector which is very seldom used. However, if we don’t find someone to plug it in for us we don’t know where to connect the cables from projector into computer’s port”. So teachers should be educated in its use according to their level of skills.

Teachers are consistently reporting an increased need for professional development to enable them to effectively use computer resources to improve students’ learning environment. This is clear from the results obtained, as out of 300 respondents 88% indicated that they could use computers at the basic and intermediate level but not at the advanced level.

As technology changes from time to time, there should be ongoing training of teachers in computer aided instruction, collaborative tools and more advanced computer systems. Finally, as commented by many teachers, workshops must be held by the IT experts to help teachers to get up-to-date training on a continuous basis. The researcher’s experiment on the use of interactive whiteboards provided evidence that ordinary classrooms can be converted to technology-rich learning spaces that are able to support teaching and learning. Unlike the computer rooms, this configuration is multi-purpose and allows for different subjects to be taught in the facility.

6.4.2 What type of network access do teachers and learners have at public secondary schools in urban and rural communities of KwaZulu-Natal to access knowledge resources?

Teachers were asked different questions in relation to what type of network access they have. Teachers were asked if they have access to the Internet to enable them to use different activities online. Most schools acquire access to Internet; but when it comes to what type of Internet speed connection they have, majority of the participants (67%) said that their speed connection is slow to download information. Internet connection is the most important factor in determining the effective outcomes. As the result shows schools have network connection speed problems that could not be disregarded. In fact, only 26% of the respondents admit that the school computers are fast to download information. Implementing faster network access could eliminate the problems that teachers may experience.

Some of the examples of frequent causes of poor Internet performance are spyware and viruses. Spyware can slow the system by interfering with the browser and monopolizing the Internet connection. Computer viruses can also cause poor Internet performance. When a virus infects a computer, it installs computer code which will attempt to propagate itself, usually by sending copies of itself through e-mail. Finally too, popular websites can become overwhelmed with users if many teachers visit the site at the same time. Schools should consider about those popular websites such as: facebook, blogs, youtube, wiki and twitter for future studies how they will be dealt.

Teachers were asked where they have access more regularly to computer equipments. The result found that teachers have access more regularly at computer rooms (66%) and at home (63%). The rest 24% of teachers have regular access to computers both at classroom

and office. As computer use continues to increase in society, teachers must also prepare for the use of computers within the classroom and office.

6.4.3 What sort of training needs to be developed about Information Technology to enable teachers to implement e-Learning as part of e-Education?

Results indicate that 49% of teachers in public secondary schools are well prepared to use e-Learning technologies for teaching and learning, and 21% of teachers are somewhat prepared for e-Learning, although they need to extend their skills. Based on three practical assessment questions to which they have assigned their knowledge of skills as basic, intermediate and advanced; the results indicated that 2/3 of respondents have good skills and 1/3 poor skills in a general set of questions. According to the White Paper on e-Education (2004), the twenty-first century will be a more globalized and knowledge-based era. Therefore, in response to this rapid change, it is imperative that public secondary school teachers in KZN are trained to use ICT in education. In today's interconnected and technology driven society, a learning environment can be virtual, online, or remote; in other words, it does not have to be a place at all when teachers and learners have the basic network facilities at school. Therefore, teachers need training and ongoing support to maximize the technology benefits of e-Education.

6.4.4 How well are the technologies and its equipment maintained at public schools in KwaZulu-Natal?

The results from the survey indicate that 61% percent of the respondents state that the maintenance provided by the schools is not fair and not up-to-date. Thirty three percent of the respondents agreed that the maintenance is fair enough and up-to-date. The rest (5%) of

the respondents neither agree nor disagree about the fairness and up-to-date maintenance of the equipment. So the schools need to reconsider the quality of the maintenance they provide for efficient and long-term use of the computer equipment. In addition to that the school person charged with handling this matter should allow equitable access to quality learning tools, technologies and resources.

6.4.5 How do the public schools use Information Technology as communication tool to network with others within the school, in the local community, and expanding out to the global community at large?

Information Technology as a communication tool provides every school with access to the use of computers and software to manage information. It allows teachers to participate in a rapidly changing world in which teaching and learning activities are increasingly transformed by access to varied and developing technologies. The Internet is recognized as a powerful learning tool that allows teachers to access a wide range of global information and communication worldwide. The board of the school recognizes that it is increasingly important for staff and learners to access information and resources responsibly.

There are a number of ways that teacher-teacher and teacher-learner can communicate with each other, rather than relying on physical presence during scheduled conferences or the old style of learning. Seventy two percent of public school teachers with access to Internet in their classroom or elsewhere indicated that they use Internet for e-mail, 27% for chat, and 33% for instant messaging to communicate with colleagues, parents and students. Fourteen percent of teachers sometimes and twenty four percent regularly use computer as a communication tool to interact in classrooms with learners.

6.4.6 How do teachers integrate Information Technology throughout the high school's curriculum?

Technology is omnipresent, touching almost every part of communities, schools, and homes. However, most schools remain far behind when it comes to integrating technology into a classroom learning environment. Many are just beginning to explore the true potential that technology offers for teaching and learning. Appropriately used, technology will help learners acquire the skills they need to survive in a multifaceted, highly technological knowledge-based economy.

Integrating technology into classroom instruction means more than just teaching basic computer skills and software programs in a stand-alone computer class. Effective technology integration must happen across the curriculum in ways that deepen and enhance the learning process. In particular, it must allow participation in groups, frequent interaction and feedback, and connection to real-world experts. Effective technology integration is achieved when the use of technology is routine and transparent and when technology supports curricular goals.

Technology also changes the way teachers teach, giving educators' effective ways to reach different types of learners and assess learners' understanding through multiple resources. It also enhances the relationship between teacher and learners. When technology is effectively integrated into subject areas, teachers grow into roles of adviser, content expert, and coach by making every day a technology day and by creating multimedia presentation teaching. Technology helps make teaching and learning more meaningful and fun.

Having 60% of teachers who do not have computer access to interact with learners in classrooms is really disappointing. All teachers and other educators are key contributors to the transformation of education in South Africa and elsewhere, and form part of a more glo-

balized and knowledge-based era. In response to this rapid change teachers need to elevate their computer access in classrooms to integrate information throughout the high school's curriculum.

6.4.7 Do teachers have adequate material to use Information Technology to support their personal and professional productivity through administrative applications and communication with colleagues and students via e-mail and throughout the classroom?

As the results show, public secondary schools need to have access to a computer in the classroom. Sixty percent of teachers (Figure 5.9) often have no access to computer in classrooms and this could actually slow learning. Forty five percent of teachers have also no access to computer in an office and this would prohibit teachers from working effectively from their office. Another result shows, as mentioned in the second set of questions in Table 5.7 depicts sixty nine percent of teachers did not agree on obtaining opportunities to learn and to integrate computers in their classroom practices. Fifty percent of respondents states using computers regularly for administrative record keeping and 33% reported using computer regularly to communicate with parents. Teachers who use ICTs should be encouraged and are less likely to use the traditional communication method.

Sixty one percent of respondents believed that the school computer equipment is not up-to-date. Forty nine percent of teachers disagreed about having a sufficient number of computers available at school. There is a vital need for more computers and other computer equipment such as printers, scanners, projectors and other devices as described in Table 4.6. There is also a need for regular upgrading of computer hardware and software and building of a computer room (Lab) to be used by learners for their computer hands-on practice.

The existence of ICTs in public secondary schools of KwaZulu-Natal does not transform teacher practices in and of itself. However, ICTs can enable teachers to transform their teaching practices, given a set of enabling conditions that teachers could interact with student and colleagues. Teacher training and continued ongoing professional development are essential if benefits from investments in ICTs are to be maximized.

In addition to that because teachers are using computers at a lesser level in the classroom it could be better if schools have at least one computer so that teachers can work effectively to facilitate record keeping, such as attendance, disciplinary matters and parent contact. Apart from that, each teacher needs a computer for preparation to deliver lecture, capture mark into the worksheets, and make planning lesson and presentations. As one teacher commented “Just about every office worker has one, why not teachers who could really use them too”.

6.4.8 How dependent are teachers on the computer hardware provided to them by the school?

From the respondents 85% own private computers and whether they own computers or not 66% of respondents use school computers, on other word depend on the computer hardware provided by schools for different reasons. Firstly, because they do not have their own computer access teachers rely on school resources. Secondly, even though they have their own computer some of the teachers do not acquire their own software either because they could not borrow it or make copy due to computer piracy or they cannot afford it to buy. Thirdly, even if they can acquire the application software, they might not know how to install the software. Therefore, generally the cost and the skills to install the software are considered as part of their workload depending on school computers.

6.4.9 For what purposes are the computers mainly used at school?

Teachers were asked for what purpose they used computers or the Internet to prepare for and manage their classes. Teachers use computers for different purposes to facilitate the learning process. Fifty seven percent of teachers who use computers or the Internet in their classroom or elsewhere indicated that they used a computer for creating instructional learning material and 50% percent of public school teachers with access to computers or the Internet in their classroom or elsewhere indicated they used computer for administrative record keeping, 33% reported using computers to communicate with parents or learners, 25% reported using computers to access model lesson plans, 31% reported using computers to facilitate research papers and best practices for teaching, 23% reported using computers for the use of multi-media classroom presentations to enhance learning materials, 20% reported using computers to gather information for planning lessons.

Although it great to have 57% of teachers using computers or Internet in their classroom or elsewhere for creating instructional learning material and 50% percent of teachers for administrative record keeping; the other activities are such as communicating with parents or learners, accessing model lesson plans, facilitating research papers and best practices for teaching, as well as gathering information for planning should be encouraged to be practiced more. Teachers require additional motivation and incentives to participate actively in professional development activities.

6.4.10 Do the principals understand the potential contribution of computer technology to learning?

Sixty five percent of the respondent disagreed saying that the principals do not understand the potential contribution of computer technology in improving of the quality of education in high schools. The rest (20%) of the respondents agreed that the principals understand the potential contribution of computer technology (See Figure 5.18).

Even if the title of the research covers broad concepts in relation to the studies of the public secondary schools saying: “the effective use of computers and emerging technologies for e-Education in public secondary schools in urban and rural communities of KwaZulu-Natal,” the researcher focused only on the teachers’ related surveys that do not combine principals.

Surely principals have other undeniable and important tasks to do; and on top of that they were not requested to express their opinions. Therefore, though the teachers are unhappy towards the principals; it is difficult to conclude teachers’ suggestion without determining what the viewpoint of the principals into the study. Therefore, in order to establish whether the suggestions by teachers are correct, a further study maybe better to include both teachers and the principals. However it is a worthwhile to mention the comments stated by the respondents as follows:

- ✓ Principals should become aware of the potential contribution of computer technology. The essential goal of principals is to support teachers’ and learners’ relationships to each other and their work field. Thus teachers need to be approached with today’s and tomorrow’s opportunities.
- ✓ Principals should attend workshops on the importance of computer studies and be advised on how this technology

can be introduced to all teachers and students. They must also be informed of which stream should take computer studies up to different grades.

- ✓ In a 21st century environment, teachers need access to the best technological tools and media-rich resources that will support them to explore, understand and express themselves. Teachers and learners need access to tools and resources to share knowledge and practices with one another. Teachers, more than learners, need access to technological tools to communicate with colleagues and professionals and even interact with experts in their field, and to be in touch with their learners' families and communities. Administrators need access to the same tools and technological resources to manage the daily complexities of the educational enterprise.
- ✓ Principals must facilitate and monitor the process for administering technology usage for all learners and teachers in the school as appropriate, as outlined in the South African Government's White Paper on e-Education. Teachers can only make a difference when learners, teachers and administrators of the school are provided with the necessary support to effectively integrate it into their daily routines.
- ✓ Principals are supposed to concentrate on fostering the conditions for school growth by helping to obtain resources, developing collaborative cultures across subgroups of teachers, supporting and pushing teacher development, creating facilitative structures, and monitoring teacher commitment as an indicator of organizational capacity.

6.4.11 Does the ministry of Education understand the potential contribution of computer technology to learning?

Seventy one percent of the respondent disagreed saying that the ministry of education does not understand the potential contribution of computer technology in improving of the quality of education in high schools. The rest (17%) of the respondents agreed that the ministry of education understands the potential contribution of computer technology (See Figure 5.19).

The same can be applied to the ministry of education as to the principals. Although the teachers are unhappy with the ministry of education; it is difficult to for the researcher to accept the teachers' suggestion without determining what the viewpoint of the ministry of education into the study. Therefore, in order to establish whether the suggestions by teachers are correct, a further study maybe taken into consideration for the further study that includes both teachers and ministry of education as population. However, it is a still worthwhile to mention the comments stated by the teachers as follows:

- ✓ The ministry of education needs to provide enough computers to school and teachers with computer skills to ensure effective teaching of educations.
- ✓ The ministry of education should play multiple roles: carrying out its traditional role of bringing information resources to learners and teachers, but also providing the tools and infrastructure that enable learners and teachers to analyse, synthesize and evaluate resources in ways that demonstrate learning and create new knowledge.
- ✓ Web presence should be promoted with the use of the country code top-level domain name.
- ✓ A policy is needed for every participant in the hi-tech industry and related fields so that a certain quota of their services is of-

ferred to the rural community and another quota towards education in the rural community for each year.

- ✓ Finally, the ministry of the Department of Education must prioritize CAT Compute studies. Less advantaged schools need to be subsidized by government. It is disheartening to find that technology is sidelined at schools because of economic reasons, lack of resources and manpower.

6.5 MAJOR FINDINGS

This research is a follow up research of Mhlane (2007), Nkabinde (2007), Mazibuko (2007) and Matsemela (2007). In comparing the similarity of the current research to the previous studies the results from the survey reveal that teachers in public secondary school in urban and rural communities are positive about the introduction of e-Education and would be willing to implement the policy of the South African Government, that says all public schools should operate as electronically managed schools by 2013 for the successful introduction of e-Education. Unlike the research done by Matsemela (2007) the majority of respondents indicated that they have received basic computer training; however, in order for teachers to effectively teach and manage all aspects of e-Education, they need advanced skills and ongoing support in the use of ICTs.

Particularly in relating to the studies of Mhlane (2007) and Matsemela (2007) results from the survey reveal that educators in rural schools of KwaZulu-Natal are not exposed to electronic communication technologies due to the lack of the necessary technological infrastructure and not having enough resources to enable rural schools to implement e-Education.

In short, in comparing and contrasting the similarity and the differences of the current research to the previous research the following major findings emanate from this study:

- ✓ Teachers have positive perceptions and attitudes towards the use of ICT to deliver e-Education and would be willing to implement the policy in the classroom.
- ✓ The majority of respondents indicated that they have received more than the basic skills and are ready for e-Education.
- ✓ The study has also demonstrated clearly that teachers need training or to be equipped with the advanced technologies to ensure successful implementation of computer education program.
- ✓ The notion of the benefit of computers in improving the quality of education should be used by the school more than they are currently provided at public schools of KZN, especially in rural communities of KZN.
- ✓ Teachers use the computer resources at schools both for academic and non-academic purposes.
- ✓ Very few teachers have been exposed to any form of e-Education.

6.6 LIMITATIONS

Completed questionnaires were obtained from only 300 teachers rather than the disseminated 500 that would have ensured greater generalization of the results. The sample included 300 teachers of public high schools out of which 100 were given to practical assessment. Due to teaching could not be disrupted at certain times; the sample size was limited and it was impossible to select respondents

based on different abilities as intended. It is evident from the study that there is a need for a subsequent more comprehensive survey to test the validity of the results that are reported here.

The results reported here would have been more valid for “Public secondary schools in urban and rural communities in KwaZulu-Natal” (refer to title of the thesis) if the perceptions and competencies of learner had been reported alongside those of teachers.

The title of the research covers broad concepts in relation to the studies of the public secondary schools saying: “the effective use of computers and emerging technologies for e-Education in public secondary schools in urban and rural communities of KwaZulu-Natal,” the researcher focused only on the teachers’ related surveys that do not combine principals and ministry of educations. It is obvious from this result that future research should include both teachers and ministry of education.

6.7 CONCLUSION

As mentioned in section 6.3, it is difficult to make generalizations from the results obtained from this research. However, the author believes that the research gave him a great deal of experience on how to research and to bring useful solutions to practical and theoretical problems.

Based on the findings of the research the researcher believes that the schools in KwaZulu-Natal can be ready for the implementation of e-Education by 2013 as envisaged in the Department of Education’s 2003 White Paper on education; if they resolved the limiting factors such as lack of exposure to new (emerging) technologies, access to fast Internet services, and lack of necessary resources.

In conclusion this chapter has summarized the work done for this thesis. Contributions to the existing body of knowledge have been identified as well as areas for further research.

ADDENDA

ADDENDUM 1: SUPERVISOR'S LETTER REQUESTING GATEKEEPER PERMISSION TO CONDUCT RESEARCH



Friday, June 15, 2007

Attention:
The Director: Research Strategy Development & ECMIS
KwaZulu-Natal Department of Education
Private Bag X05
ROSSBURGH 4072

Dear Mr. Mthabela

PERMISSION SOUGHT TO DO RESEARCH AMONG TEACHERS SCHOOLS IN THE KZN DOE REGARDING
READINESS FOR THE INTRODUCTION OF E-EDUCATION

One of my masters students, Mr. G. Embaye Woldu, (student number 200102419) is doing an empirical study on the topic above, for which he has to use about 400 secondary school teachers as respondents.

I am hereby applying for permission in principle for him to contact principals in your jurisdiction for the purposes of such research.

- Participation will be on a voluntary and anonymous basis.
- The survey will be of a constructive nature.
- The student's research proposal and his questionnaire, is attached for your information.
- After obtaining permission from you, the principals of a number of randomly selected schools will be approached to give him access to teachers who will serve as respondents.
- The questionnaires emphasize the anonymous and voluntary nature of their participation.
- The researcher will conduct the surveys himself at times designated as appropriate by the principals.
- The KZN Department of Education will be acknowledged in the dissertation, of which a copy will be provided to the Department upon completion.

KIND REGARDS

Prof. Rembrandt Klopper

Postgraduate Research Coordinator
School of Information Systems & Technology
Westville Campus
Postal Address: Private Bag X54001, Durban 4000

Telephone: +27 (0) 31 260-7704 Facsimile: +27 (0) 31 260-7251 E-mail: rklopper@ukzn.ac.za Website: www.ukzn.ac.za
Founding Campuses: Edgewood Howard College Medical School Pietermaritzburg Westville

ADDENDUM 2: GATEKEEPER'S LETTER GIVING PERMISSION TO CONDUCT RESEARCH



PROVINCE OF KWAZULU-NATAL
ISIFUNDAZWE SAKWAZULU-NATALI
DEPARTMENT OF EDUCATION
UMNYANGO WEMFUNDO

Tel: 033 341 8610
Fax: 033 341 8612
Private Bag X9137
Pietermaritzburg
3200
228 Pietermaritz Street
PIETERMARITZBURG

INHLOKHOVISI	PIETERMARITZBURG	HEAD OFFICE
Imibuzo: Enquiries: Sibusiso Alwar	Reference: Inkomba: 0064/2009	Date: Usuku: 13 October 2009

MR G E WOLDU
UNIVERSITY OF KWAZULU NATAL
WESTVILLE CAMPUS
PRIVATE BAG X54001
DURBAN
4000

PERMISSION TO INTERVIEW LEARNERS AND EDUCATORS

The above matter refers.

Permission is hereby granted to interview Departmental Officials of the Province of KwaZulu-Natal Department of education subject to the following conditions:

1. You make all the arrangements concerning your interviews.
2. Work programmes are not interrupted.
3. Departmental officials are not identifiable in any way from the results of the interviews.
4. Your interviews are limited only to the province of KwaZulu Natal.
5. A brief summary of the interview content, findings and recommendations is provided to my office.
6. A copy of this letter is submitted to District Managers where the intended interviews are to be conducted.

The KZN Department of education fully supports your commitment to research: **The effective use of computers and emerging technologies for e-education in public secondary schools in urban and rural communities in KwaZulu natal**

It is hoped that you will find the above in order.

Best Wishes

R Cassius Lubisi, (PhD)
Superintendent-General

RESOURCES PLANNING DIRECTORATE: RESEARCH UNIT
Office No. G25, 188 Pietermaritz Street, PIETERMARITZBURG, 3201



PROVINCE OF KWAZULU-NATAL
ISIFUNDAZWE SAKWAZULU-NATALI

DEPARTMENT OF EDUCATION
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Tel: 033 341 8610
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Private Bag X9137
Pietermaritzburg
3200

228 Pietermaritz Street
PIETERMARITZBURG

INHLOKHOVISI

PIETERMARITZBURG

HEAD OFFICE

Imibuzo:
Enquiries: Sibusiso Alwar

Reference:
Inkomba: 0064/2009

Date:
Usuku: 13 October 2009

MR G E WOLDU
UNIVERSITY OF KWAZULU NATAL
WESTVILLE CAMPUS
PRIVATE BAG X54001
DURBAN
4000

**RESEARCH PROPOSAL: THE EFFECTIVE USE OF COMPUTERS AND EMERGING
TECHNOLOGIES FOR E-EDUCATION IN PUBLIC SECONDARY SCHOOLS IN URBAN AND RURAL
COMMUNITIES IN KWAZULU NATAL**

Your application to conduct the above-mentioned research with Departmental officials had been approved subject to the following conditions:

1. Departmental officials are under no obligation to assist you in your investigation.
2. Departmental officials should not be identifiable in any way from the results of the investigation.
3. You make all the arrangements concerning your investigation.
4. Work programmes are not to be interrupted.
5. The investigation is to be conducted from 13 October 2009 to 13 October 2010.
6. Should you wish to extend the period of your survey please contact Mr Sibusiso Alwar at the contact numbers above.
7. A copy of this letter is submitted to the District manager where the intended research is to be conducted.
8. Your research will be limited to province of KwaZulu Natal
9. A brief summary of the content, findings and recommendations is provided to the Director: Resource Planning.

10. The Department receives a copy of the completed report/dissertation/thesis addressed to

The Director: Resource Planning
Private Bag X9137
Pietermaritzburg
3200

We wish you success in your research.

Kind regards



R. Cassius Lubisi (PhD)
Superintendent-General

ADDENDUM 3: COMPLETION OF LANGUAGE EDITING

Dr M M Spruyt

BA Hons MA D.Litt

***30 Gardenia Street
HELDERVUE 7130***

*Telephone and fax: 021 855 4404
Cell 0824603955*

TO WHOM IT MAY CONCERN

EDITING OF MASTER'S THESIS

This is to certify that I have edited the thesis:

*THE EFFECTIVE USE OF COMPUTERS AND EMERGING TECHNOLOGIES IN
PUBLIC SECONDARY SCHOOLS IN URBAN AND RURAL COMMUNITIES OF
KWAZULU-NATAL*

submitted by **Ghebre Embaye Woldu** to the best of my ability and declare it free of language errors. The changes I have indicated concerning the thesis have been made.



DR MM SPRUYT

ADDENDUM 4: PERMISSION FROM RESPONDENTS TO CONDUCT RESEARCH



Respondent Number: _____

Letter of informed consent to be signed by all respondents

Research Project:

The effective use of computers and emerging technologies for e-Education in public
secondary schools in urban and rural communities of KwaZulu-Natal

Researcher:

Supervisor: Prof. Rembrandt Klopper
School of Information Systems & Technology
Faculty of Management Studies
University of KwaZulu-Natal

I _____ (full names of
participant) hereby confirm that I understand the contents of this document
and the nature of the research project, and I consent to participating in the
research project. I understand that I am at liberty to withdraw from the
project at any time, should I so desire. I hereby give permission that my res-
ponses may be used in the above research project, provided that no of my
personal details will be made public in the published research report.

Signature _____ **Date** _____

ADDENDUM 5: RESEARCH INSTRUMENTS

(Questionnaire and Observation Schedule)

For Office Use Only: Respondent code: _____



VOLUNTARY QUESTIONNAIRE FOR SCHOOL TEACHERS IN KWAZULU-NATAL PUBLIC SECONDARY SCHOOLS

The Effective Use of Computers and New Technologies for e-Education in Public Secondary Schools in Urban and Rural Communities of KwaZulu-Natal

“If you fail to prepare, you are preparing to fail!!”

Researcher: Ghebre Embaye Woldu (031 3093496)

Supervisor: Prof. Rembrandt Klopper (031 2607704)

School of Information Systems and Technology

University of KwaZulu-Natal

Notes to the respondent

- We need you to help us understand how teachers use computers and other new technologies in their daily teaching tasks.
- Although we would like you to help us, you are not obliged to take part in this survey.
- If you do not want to take part, just return the blank questionnaire to the researcher.

- What you say in this questionnaire will remain private and confidential. No one will be able to trace your opinion back to you as a person.
- We can only use your responses if you give us permission by signing the accompanying letter of informed consent.

How to complete this questionnaire

1. Please answer the questions as truthfully as you can. Also please be sure to read and follow the directions for each part. If you do not follow the directions and instructions, it will make it harder for us to do our project.
2. We are only asking you about thing that you and your fellow teachers should feel comfortable telling us about. If you do not feel comfortable answering a question you can indicate that you do not want to answer it. For those questions that you do answer, your responses will be kept confidential.
3. You can indicate each response by making a tick or a cross, or encircling each appropriate response with a PEN (not a pencil), or by filling in the required words or number.

Thank you very much for completing this questionnaire.

Your Personal Information

1. I am:
 - ☐ Female
 - ☐ Male

2. I grew up in:
 - ☐ A rural area
 - ☐ A semi urban area
 - ☐ An urban area

3. I live in the _____ region of the KZN Department of Education

4. I belong to the following ethnic group:
 - ☐ An African / Black
 - ☐ Indian / Asian
 - ☐ White
 - ☐ Coloured
 - ☐ A member of another ethnic group: _____

5. My age falls within the range:
 - ☐ 20 to 29
 - ☐ 30 to 39
 - ☐ 40 to 49
 - ☐ 50 to 59
 - ☐ 60 or older

6. I have the following number of years of teaching experience:
 - ☐ 20 or more
 - ☐ 10 to 19
 - ☐ 4 to 9
 - ☐ 3 or fewer

7. Do you teach the following grades?(tick all relevant grades)	Yes	No
a) Grade 8		
b) Grade 9		
c) Grade 10		
d) Grade 11		
e) Grade 12		
f) I do not teach any grades		

General Information about your Access to Computers

Please tick only one option per question.

8. Where is your school located?

- ☐ *Urban area* (well supplied infrastructure like electricity at homes, water taps at homes, tarred roads, street lights and public transport)
- ☐ *Suburban area* (less developed infrastructure having only some services like electricity at homes, water taps at homes, tarred roads, street lights and public transport)
- ☐ *Rural area* (poorly developed infrastructure with few or no services like electricity at homes, water taps at homes, tarred roads, street lights and public transport)

9. Do you have access to Personal Computer (PC) or a notebook computer at home?

- ☐ Yes
- ☐ No

10. How often do you have access to a computer at the following places?	Regularly	Sometimes	Never
a) Computer room			
b) Classroom			
c) Internet Cafe			
d) Home			
e) Office			

11. On average, how often do you use a computer (either at work or at home)?

- ☐ Every day
- ☐ Several times a week
- ☐ Once a week
- ☐ Once every two weeks
- ☐ Once a month
- ☐ Rarely
- ☐ Never

12. How many hours per day do you use a computer when you do use it?

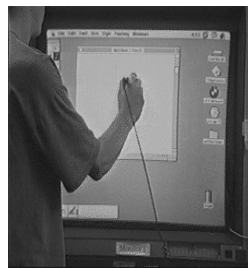





- ☐ 8 hours or more at a time
- ☐ 4 to 7 hours at a time
- ☐ 1 to 3 hours at a time
- ☐ Less than an hour at a time
- ☐ I don't ever use a computer

13. How would you assess your computer skills?

- ☐ I have advanced computer skills
- ☐ I have intermediate computer skills
- ☐ I have basic computer skills
- ☐ I have no computer skills

14. How often do you use a computer for the following functions?	Regularly	Sometimes	Never
a) To create instructional learning material			
b) For administrative record keeping			
c) For multimedia classroom presentations			
d) To communicate with parents and friends			
e) To communicate with colleagues			
f) To gather information for preparing lessons			
g) To access research and best practices for teaching			
h) To find model lesson plans on the Internet			

15. How often do you use the computer equipment listed below for teaching and learning in the classroom?	Regularly	Sometimes	Never
Basic Technology	a) Floppy disk		
	b) Printer		
	c) CD/DVD ROM		
	d) Scanner		
Standard Technology	e) Overhead Projector		
	f) USB flash drive		
	g) Digital camera		
	h) Webcam (Web camera)		
	i) Laptop (Notebook Computer)		

Advanced Technology		Regularly	Sometimes	Never	Examples of new communication devices
	<p>j) Digital Whiteboard/ Interactive Smart Board</p> <p>A Smart Board is an interactive electronic white board that can interface with a computer and a media projector in the classroom. One can project previously prepared text or images onto the Smart Board. What is written or drawn on the board can be converted to text or graphics and saved on the computer. One can also download data off the Internet and project it on the Smart Board.</p>				
	<p>k) Smart phones and PDAs</p> <p>A smartphone is generally considered any hand-held device that integrates personal information management and mobile phone capabilities in the same device. Often, this includes adding phone and computing functions to personal digital assistants (PDAs) and to Windows Pocket PCs, or putting "smart" capabilities, such as a clock, an alarm, reminders, e-mail, Internet browsing, word-processing, and spreadsheets into mobile phones for business purposes.</p>				
	<p>l) GPS (Global Positioning System)</p> <p>GPS refers to satellite-based radio positioning systems that provide 24 hours three dimensional position, velocity and time information to suitably equipped users anywhere on or near the surface of the Earth.</p>				
	<p>m) iPod</p> <p>The generic brand iPod refers to a class of portable digital audio players designed and marketed by Apple Computer. Most iPod models store media on a built-in hard drive, while a lower-end model, iPod shuffle, relies on flash memory.</p>				
	<p>n) Games machine like PlayStation 3 and XBOX</p> <p>When connected to a TV or computer screen these machines can be used as standalone devices to play computer games, or for home networking (to integrate audio and visual forms of entertainment).</p>				<div>  <p>Play Station 3</p> </div> <div>  <p>XBOX</p> </div>

16.What do you mainly use a computer for?	Yes	No	I don't know
a) E-mail			
b) Internet			
c) Research			
d) Fine arts (drawings)			
e) Naughty websites (such as fun sites, porno sites)			
f) Chat			
g) Instant Messaging			
h) Games			

17.How regularly do you use the following computer software?	Regularly	Sometimes	Never
a) Microsoft Word			
b) Microsoft Excel			
c) Microsoft PowerPoint			
d) Microsoft Access			
e) Microsoft Outlook			
Other:	1)		
	2)		
	3)		

18. How long does it take you do the following?	I don't do this	Very Fast	Fast	Average time	Quite slowly	Very slowly
a) Download information from remote computers via the Internet						
b) Upload information to remote computers via the Internet						
c) Open the website page on the Internet						
d) Turn on the computer or booting up (starting up)						
e) Save documents						

19. Please tick the appropriate option for each of the questions below:	Yes	No	I don't Know
a) In your view, are computers evenly distributed between Public Schools?			
b) Are the teachers given opportunities to learn to integrate computers in their classroom practices?			
c) Has your school introduced a remote education system (e-Learning)?			
d) Has your school introduced Computer Assisted Instruction (CAI)?			
e) Does your school have a teacher who teaches computer studies?			
f) Does the South African Government standardize computer studies as a subject in the province?			
g) Does your school have access to the Internet?			
h) Does your school have an e-mail account?			

20.To what extent do you agree with the following statements?	Totally agree	Partially agree	Neither agree nor disagree	Partially disagree	Totally disagree
a) There is a sufficient number of computers available at my school.					
b) The school computer equipment is not up-to-date.					
c) Emerging technologies (e.g. whiteboard, GPS) are user friendly / not difficult to use.					
d) All teachers should learn how to use computers.					
e) Computers are of little value in the classroom because they are too difficult to use.					
f) Computers at school should be used for academic purposes only. Restrictions should be placed on non-academic activities.					
g) Currently the school administrations are done on an integrated Management Information System (MIS) administration of IT.					
h) Computers should be used by schools more than they are now.					
i) Principals do not understand the potential contribution of computer technology.					
j) Ministry of the Department of Education does not understand the potential contribution of computer technology to learning.					

21. How well prepared are you to use e-Learning methods?

- ☐ Very well prepared
- ☐ Well prepared
- ☐ Somewhat prepared
- ☐ Not at all prepared

22. Does your school have a website?

- ☐ Yes, very well designed
- ☐ Yes, well designed
- ☐ Yes, but not poor nor well designed
- ☐ Yes, but poorly designed
- ☐ No, not at all

23. Please provide any additional comments about how your school could achieve efficient and effective use of computer?

[illegible]

Thank you again for completing this questionnaire.

Observation of Respondents' Practical Computer Skills

This is a selective assessment of three computer skills in relation to respondents' prior statements about their level of literacy

24. Assessment of candidate's response :

Task to perform		Bad	Not bad	Good	Very good	Excellent
Basic Assessment	j) Please turn on the computer.					
	k) Please show me how you save the document called <i>Sample Document</i> on the desktop in the <i>Sample document Folder</i> on the USB flash drive.					
	l) Please turn off the computer					
Standard Assessment	m) Please open and close the software program that you use to record learners' tests and assignment scores.					
	n) Please show me in MS Word what you will do to print only pages 1 and 3 of the document.					
	o) Please show me in MS Word what you would do to insert a table of contents in a document.					
Advanced Assessment	p) Please write one paragraph on how you could spend your weekend and when you finish run the spell check.					
	q) Please show me how you would import a document from MS Word to MS Excel.					
	r) Please show me how you would capture an image of your computer screen by using the keyboard only.					

ADDENDUM 6: CONCEPT MATRIX

<div>Concepts</div> <div>References</div>	Hardware & Software	Problem Statement	The Purpose or Goal of Study	Advantages of Using Computer in Education	Disadvantages of Using computer in Education	Factors that Influence the Use of Computer	Emerging / Technologies in education	Benefits of Internets	Distance Education	e-Readiness & e-Education	Limitations of Distance education	Network	Research Methodology	Implication for teaching to use technology
Abbot & Farris, 2000														✓
American Youth Policy Forum, 2000							✓							
Australian Council for Computer Education (ACCE), 2005		✓		✓										
Baker, 1997			✓											
Barrett, 1996				✓										
Basaza, 2006								✓						
Beare, 2007					✓									
Beebe, 2004							✓							
Bengu, 1996				✓					✓					
Betsy, 2003			✓											
Blurton, 2002										✓				
Bridge.Org, 2002										✓				
Bridge.Org, 2005										✓				
Brown, 2006							✓							
Bullock, 2004				✓										
Capron & Johnson, 2002				✓				✓						
Christopher, 2006								✓						
Cornu, 2005		✓												
Cradler et al., 2002														✓
Criss, 2004					✓									
Curriculum, 2005										✓				
Dede, 2008			✓											
Deitel et al., 2001								✓						
Docktor, 2002										✓				
DoE, 2004										✓				
DoE, 2006										✓				
Dwyer et al., 1991						✓								
Economic Intelligence Unit, 2002										✓				
Economic Intelligence Unit, 2008										✓				
EMIS, 2007													✓	

<div>Concepts</div> <div>References</div>	Implication for teaching to use technology	Research Methodology	Network	Limitations of Distance education	e-Readiness & e-Education	Distance Education	Benefits of Internets	Emerging / Technologies in education	Factors that Influence the Use of Computer	Disadvantages of Using computer in Education	Advantages of Using Computer in Education	The Purpose or Goal of Study	Problem Statement	Hardware & Software
Eisenberg & Johnson, 2002													✓	
Finland's EU presidency, 2006											✓			
Fallows & Rainie, 2004											✓			
Frayser, 2002									✓					
Gahala, 2001				✓									✓	
Gillwald & Kane, 2003					✓									
Global Positioning System (GPS), 2008								✓						
Greenhalgh, 2001							✓							
Hartley & Worthington-Smith, 2003							✓							
Hinds & Kiesler, 2002									✓					
Hodorwicz, 2000											✓			
Ifinedo, 2005					✓									
iPod, 2008								✓						
ISTE, 2000														✓
Ivala, 2000							✓							
Jeffery, 2003											✓			
Jenkin & Springer, 2002							✓							
Joppe, 2004														✓
Klopper, 2008													✓	
Klopper <i>et. al.</i> , 2005					✓									
Kmitta & Davis, 2004												✓		
Lane, 2005								✓						
Lenhart, 2001							✓							
Livesey, 2008														✓
Long & Long, 2000							✓							

Concepts References	Hardware & Software	Problem Statement	The Purpose or Goal of Study	Advantages of Using Computer in Education	Disadvantages of Using computer in Education	Factors that Influence the Use of Computer	Emerging / Technologies in education	Benefits of Internets	Distance Education	e-Readiness & e-Education	Limitations of Distance education	Network	Research Methodology	Implication for teaching to use technology
Lubbe & Klop- per, 2004													✓	
Macdonald, 2002		✓						✓						
Markle Founda- tion, 2001										✓				
Matsemela, 2007										✓				
Matthew & Dohery-Poireir, 2000								✓						
Mawandia, 2006										✓				
Mazibuko, 2007										✓				
McCarthy, 2003								✓						
McDermott, 2007								✓						
McLean, 2003								✓						
McNutt, 1996								✓						
Mhlane, 2007										✓				
Microsoft Cor- poration, 2004				✓										
Microsoft Cor- poration, 2007		✓												
Mitchell, 1999												✓		
Mogey & Watt, 1999				✓										
Mokhesi, 2000		✓												
Morley & Park- er, 2007				✓										
NCES, 2000														✓
Nkabinde, 2007										✓				
Oblinger, 2008							✓							
Odero, 2002										✓				
Olalere, 2005			✓											
Osin, 1998				✓		✓								
Otter, 2006										✓				
Parusnath, 2002				✓				✓						
Patton, 2001													✓	
Penfield & Lar- son, 1996								✓						
Philips, 2000		✓												
PlayStation 3, 2008							✓							

Concepts References	Implication for teaching to use technology	Research Methodology	Network	Limitations of Distance education	e-Readiness & e-Education	Distance Education	Benefits of Internet	Emerging / Technologies in education	Factors that Influence the Use of Computer	Disadvantages of Using computer in Education	Advantages of Using Computer in Education	The Purpose or Goal of Study	Problem Statement	Hardware & Software
Quaynor, 2002					✓									
Read, 2005								✓						
Reeves, 1999								✓						
Richard & Brent, 2001				✓										
Rosenberg, 2004				✓										
Schmitt, 2008													✓	
Schmidt et al., 2004												✓		
School Register of Needs Survey, 2000					✓									
Seneviratne, 2007					✓									
Shelly et al., 2008						✓								
Shuler, 2009								✓						
Smart board technology, 2008								✓						
Smartphone, 2008								✓						
Smith, 2008														
SnapshotSpay, 2008										✓				
Spottes & Bowman, 1995									✓					
Stearman, 2000											✓			
Stein, 1999										✓				
Trochim, 2006														
UN Millennium Development Goals, 2008					✓									
UNESCO, 2008					✓									
Usun, 2004														✓
White Paper on e-Education, 2003					✓									
White Paper on e-Education, 2004					✓									

Implication for teaching to use technology			
Research Methodology			
Network			
Limitations of Distance education			✓
e-Readiness & e-Education			
Distance Education			
Benefits of Internets			
Emerging / Technologies in education			
Factors that Influence the Use of Computer			
Disadvantages of Using computer in Education	✓		
Advantages of Using Computer in Education		✓	
The Purpose or Goal of Study			
Problem Statement			
Hardware & Software			
<div> <div>Concepts</div> <div>References</div> </div>	Wiley, 2005	Williams, 2002	Willis, 2003

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UNIVERSITY'S ETHICAL CLEARANCE LETTER



RESEARCH OFFICE (GOVAN MBEKI CENTRE)
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15 OCTOBER 2008

MR. GE WOLDU (200102419)
INFORMATION SYSTEMS & TECHNOLOGY

Dear Mr. Woldu

ETHICAL CLEARANCE APPROVAL NUMBER: HSS/0414/07M

I wish to confirm that ethical clearance has been approved for the following project:

"The effective use of Computer & Emerging Technologies for e-Education in Public Secondary Schools in Urban Rural Communities of KwaZulu-Natal"

PLEASE NOTE: Research data should be securely stored in the school/department for a period of 5 years

Yours faithfully

MS. PHUMELELE XIMBA

cc. Supervisor (Prof. R Kloppe)
cc. Mrs. C Haddon

