DEFICIENCIES IN THE INTEGRATION OF COMPUTERS IN A SELECTED SCHOOL IN THE RUSTENBURG DISTRICT

by

JOY MPHO SEGAOLE

MINI-DISSERTATION

submitted in partial fulfilment of the requirements for the degree

MAGISTER EDUCATIONIS

in

COMPUTER-BASED EDUCATION

in the

FACULTY OF EDUCATION AND NURSING

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RAND AFRIKAANS UNIVERSITY

Supervisor: DR D VAN DER WESTHUIZEN

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OPSOMMING

Die oogmerk van hierdie studie was om die tekortkominge van die integrasie van rekenaars by 'n geselekteerde skool in die Rustenburg-distrik aan die lig te bring.

Die gebruik van rekenaars in onderrig kan 'n positiewe impak op die leerproses binne die klaskamer hê. Dit is egter nie die tegnologie self nie, maar die wyse waarop dit aangewend word, wat dit 'n waardevolle of waardelose aktiwiteit maak Die onderwyser bly die belangrikste faktor in die leerproses deurdat die onderwyser bepaal wat daar geleer gaan word. Logieserwys is die professionele ontwikkeling van die klasonderwyser van kritieke belang om die effektiewe gebruik van die rekenaar te verseker. Professionele ontwikkeling van onderwysers met betrekking tot die integrasie van rekenaars in die kurrikulum het tot nou toe tekort geskiet. Onderwysers is nie onderlê in die onderrig- en leerfilosofie wat die gebruik van die rekenaar in die klaskamersituasie ten grondslag lê nie.

Professionele ontwikkeling van onderwysers, soos aangetoon, is 'n groot en duur taak waarsonder die soort onderrig wat vandag vereis word, nie kan plaasvind nie. Vir die meeste onderwysers behoort die professionele ontwikkeling op 'n filosofiese vlak te begin, en van daar af tot 'n meer praktiese, uitvoerbaarheidsvlak te ontwikkel. Dit sal egter tyd neem om dit dit te bereik. Nieteenstaande is daar reeds tekens dat hierdie veranderinge in skole plaasvind.

Die bevindinge van hierdie studie toon dat daar 'n spektrum van probleme is, wat opgelos moet word voordat 'n algemene verandering kan plaasvind, meer as die professionele ontwikkeling wat van die onderwyser insluit. Ander rolspelers, asook die staat, moet daarby betrek word. Leerders moet ook meer toegewyd wees aan hul studies en verhoogde produksie van die eindprodukte word ook vereis. Ten spyte van ekstra druk wat dit op onderwysers kan plaas, smag baie onderwysers daarna om in so 'n atmosfeer te kan werk. Dit op sigself kan die nodige aansporing wees vir onderwysers om die uitdaging te aanvaar om opvoedkundige rekenarisering en ander tegnologie in hul onderrigprosedures te inkorporeer.

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CHAPTER 1

BRIEF BACKGROUND AND PROBLEM FORMULATION

1.1 INTRODUCTION

Developments in education that emphasise child-centred, constructivist and problem-solving approaches, together with the opportunities offered by more powerful and user-friendly software, have resulted in a trend towards the integration of computers in education worldwide. While there is a growing body of evidence that the incorporation of computers in the educational setting offers opportunities for the enhancement of the learning environment, there is some doubt as to the effectiveness of these implementations in the South African context.

This uncertainty has not been adequately investigated. In South Africa to date, computers have been found predominantly in the business sector, which actively seeks people with critical and creative thinking skills, rather than in schools. In this study I will attempt to determine the problems associated with the integration of computers as educational tools in a selected school in the Rustenburg district, and how these difficulties might be addressed.

1.2 CONTEXT AND THE RATIONALE FOR THE STUDY

The main focus of this study is to investigate the implementation and integration of computers in the school curriculum in a South African school context, more specifically in the selected school in the Rustenburg district.

1.2.1 Context

On the surface, it appears that the availability of computers to learners at this school has provided greater opportunities of access to computers. While this is desirable, the true test of success lies in the integration of computers within the curriculum. A selected school in the Rustenburg district is insufficiently equipped with computers. The ratio of learners to computers during any particular lesson is approximately 3:1; three learners share one computer during class time. With an enrolment of approximately 900 learners, all of whom study functional computing,

only four classes do computer studies, an examination subject. When these learners write tests or examinations there are not enough computers for everyone to write at the same time, which creates a problem.

The school has two technology laboratories, a newly installed infrastructure. There is an independent local area network (LAN) server, twenty networked computers and two Laser Inkjet printers in each laboratory. Six other computers are used in the offices of the principal, the two deputy-principals, the heads of department and the school secretary. Network administrators are employed by the school to connect the LANs.

There is a specialist teacher in charge of teaching learners to use the computers, according to the school's timetable. The school has neither Internet access nor any explorer software such as Netscape; the computers are not configured to give users access to the library of resources available on compact disks, the second computer lab or the administration offices. The software installed is Microsoft Office '98. At this stage, the greatest problems appear to be in the areas of user support and equipment maintenance.

According to the teachers at this school, the most important advantage of access to a computer laboratory is that all learners are provided with hands-on experience in computer technology. They believe that there is an added benefit of allowing learners to interact with learner-centred technology and software. Educators are beginning to recognise that they must familiarise the leaders of tomorrow with the technologies that will play a major part in their futures.

It appears that the effective use of computers in the classrooms by teachers, however, remains an elusive goal in this school in the Rustenburg district. Computers are clustered in a room (laboratory) and students gain access to the laboratory only at scheduled class times. A specialist computer teacher is appointed to facilitate computing lessons; this encourages the classroom teacher to leave computing to the specialist.

Poole (1995:198) confirms that integrating information technology into educational settings requires change; that it requires a transformation of teachers' pedagogical beliefs, as well as in their practices. This adjustment is as

much a cultural one, as one of mere methodologies. A selected school already has the infrastructure (secure buildings, hardware and software, electricity, furniture and air conditioners, etc.); what is now required is a shift in teaching paradigms: a modification in the way of thinking about teaching.

According to Sherwood (1993:74) the transposition from scientific knowledge to 'knowledge to be taught' has not yet taken into account new technologies. Schools should make a move to integrate computers in education. The effect of incorporating information technology (IT), on the one hand, is to reinforce the professional dimension of teaching. On the other, it draws attention to inadequate pre-service teacher training courses, and the fact that inappropriate in-service workshops do not prepare teachers to integrate computers in education.

A final point concerning the context is related to equipment maintenance at the school. The customary one to three year warranties on new equipment do not apply, as learners often vandalise these computers, thus invalidating such a warranty. As an alternative, the school has entered a partnership with certain mining companies in Rustenburg for funds to purchase necessary hardware and software.

1.2.2 The need for the integration of computers in schools

When used appropriately, technology has the potential to enhance students' achievements and to assist them in meeting learning objectives. Computers that have access to the Internet allow communication beyond the classroom walls. They also enable schools and communities to provide an environment for cooperative learning, development of higher order thinking skills, and the solving of complex problems. Computers can provide unique, effective, and powerful opportunities for many different types of instruction and learning. Several leading national and International organisations, including the International Society for Technology in Education (ISTE), support education and educators in the use of technology (Shelly, GB; Cashman, TJ; Gunter, RE & Gunter GA, 1999:1.27).

Education and training are widely regarded as the mechanisms or tools that society needs in order to sustain global competitive advantage, and to maintain

and improve standards of living (Minoli, 1996:4). According to Tiffin and Rajasingham (1995:xii), growing demands exist for access to education. Dunlap (1998:295) indicates that lifelong learning has become essential in the information society in which we live, and that people need to 'retool' their knowledge and skills base, in order to keep current in a climate of rapid change and technological innovation.

1.2.3 The rationale for the study

The rationale for the study therefore incorporates the following aspects:

- computers appear the most likely means by which the need for education can be addressed;
- technology plays an increasingly important role in education in general;
- lack of familiarity with computer hardware and software is a threat to a teacher's sense of competence and authority. Teachers are one of the human dimensions in the use of technology in the classroom;
- teaching can adapt to the computer as a potentially powerful and flexible alternative mode of delivery. Learning can change because the focus can increasingly be on the access to, and the management of, knowledge, rather than on rote acquisition of facts. The integration of computers in education has created shifts in curriculum objectives and a modification in the relationship between teacher and student; and
- computers can also provide many unique, effective, and powerful opportunities for teaching and learning. These opportunities include skill-building practice, real-world problem solving, interactive learning, discovery learning, as well as linking learners to instructional resources (Shelly et al, 1999:1.18).

Watson & Tinsley (1995:134) state that the integrated use of computers in education will force a change in the content of subjects, just as their use changes the content of work in business and industry. An increasing range of jobs demands the skills of individuals who are able to use computers. The structure of

society is changing, supported by IT.

Educational technology has positive effects on learners' attitudes to self-learning and learning. Its potential is to enhance teaching and learning, with a need to use technology to present, and represent, ideas. Furthermore the so-called information age in which we live demands skills and coping mechanisms that were previously unnecessary.

Through the integration of IT in a broad range of subjects, learners will learn that computers are tools that can be used in numerous ways, in all areas of schooling and beyond. If the aim is to create lifelong learners, then teachers must provide learners with the basic understanding that computer skill is not a separate course that you do at school. It is an instrument that, used in today's society, will help learners to become informed citizens in an ever-changing, information-driven society.

The increased use of computers within schools will greatly improve computer literacy for learners. By increasing the number of computers in the schools, the 'less fortunate' learner is offered a more equitable education, which will allow him to compete with the 'more fortunate' learner. Computers offer a wide range of special provisions to enhance the learning experience of those with barriers to learning. Because computers do not have feelings, they do not become frustrated when students experience difficulty (Hannafin & Peck, 1988:34), as a teacher might do.

1.2.4 Computers in education in the South African context

To use the computer effectively for all subjects requires a large volume of study material that is in relatively short supply in South Africa. The educator must continuously be on the lookout for new applicable software that becomes available. According to Els (2000:6), study materials that are developed overseas are often not suitable for use in South Africa as there are differences in factors such as syllabus, culture, history, values and norms.

I believe that programmed instruction challenges the dynamics of the model of education in regard to control of learning, taking the control out of the hands of

the teacher and placing it in the hands of the computer software programmer. Many teachers who encountered early programmes developed "anti-technology" attitudes. In most cases software programmers are based overseas, and only a small portion of South African syllabus is covered. Software may be unaffordable as it is expensive.

Kader Asmal (the South African Minister of Education) is quoted in the Sowetan newspaper as saying that "in 1999, a study into the development of a dedicated educational broadcasting service recommended that government and the private sector work collaboratively to support the convergence of technologies. It argued for the development of an educational network and support structure to reinforce information society developments in education." (Mecoamere, 2002:2).

The Technology Enhanced Learning Initiative (TELI) of 1996-7 provided the first set of guidelines for Information and Communication Technology (ICT) in education. Minister Asmal said, "It created an awareness of the potential of the various technologies. It also promoted the integration of ICT into the teaching and learning environment insisting that education principles should shape the choice of technology" (Mecoamere, 2002:2). Asmal further pointed out that the most comprehensive and significant policy progress was made with the launch of the strategy for ICT in education, inaugurated in November 2001, with the following target:

- All educational institutions will posses a means of telecommunication (landline or cell-phone).

- With the scarcity of computers for administration and support purposes, educational institutions will have access to internet-linked computing facilities for pupil and teacher use;

- At the end of the foundation phase, all pupils will have used computers in the acquisition and enhancement of language skills.

- Pupils and teachers will have basic competency in the use of word processing, spreadsheet, flat database, e-mail and web browser applications. Pupils and teachers will have used a host of user-machine

interfaces, including keyboards, touch pads and other devices.

- Education software will comply with the curriculum 2005 assessment standards and the department of education portal – Thutong – will provide access to curriculum and support material.

Asmal was further quoted by Mecoamere (2002:2) as saying: "Mention must also be made of President Mbeki's commitment to establish an ICT university, consideration was being given to the development of courses that would prepare teachers for the new learning areas of curriculum 2005" [sic].

1.3 RESEARCH PROBLEM

This context prompted a study to investigate the use of computers in the school curriculum in a South African context, particularly in the selected school in Rustenburg.

The research question is framed as follows: What are the deficiencies in integrating computers in a selected school in the Rustenburg district and how might these limitations be addressed?

The following sub-questions may be generated from the research question:

- What theoretical frameworks exist for the integration of computers in schools?
- What shortcomings exist in integration attempts at the selected school in the Rustenburg district?
- What integration approach will best facilitate the implementation of computers in a selected school in the Rustenburg district?

1.4 AIM AND OBJECTIVES

The aim and objectives of this study are stated below.

1.4.1 Aim

The aim of the study is to investigate the method of integrating computers into the

curriculum at a selected school in the Rustenburg and to propose ways at addressing the deficiencies experienced in the integration process.

1.4.2 Objectives

The objectives of the study are

- To determine the frameworks that exist for the integration of computers in the selected school in the Rustenburg district;
- To explore and describe the extent to which the integration of computers can improve learning in the selected school; and
- To make recommendations as to how computers can be integrated to facilitate teaching and learning in a selected school in the Rustenburg district.

1.5 OVERVIEW OF THE RESEARCH METHODOLOGY

This paragraph touches on the principle features of the methodology used; a full account is set out in Chapter 3.

1.5.1 Research design

The research design is predominantly qualitative. For the purpose of this essay, qualitative research is broadly what Mason (1997:4) proposes. She contends that qualitative research has one or both of the following features:

- It incorporates data generators, which are flexible and sensitive to the social context in which data are produced.
- It is based on the methods of analysing and explanation building, which involves an understanding of complexity, detail and context.

Qualitative research, according to Mason (1997:4) and Tesch (1990:43), is naturalistic and is associated with, amongst others, field research, ethnographic research, action research, case studies and phenomenological studies. Key concepts associated with qualitative research are meaning, understanding, social

construction and context. For the purpose of this study, qualitative research is regarded as suitable because:

- A single researcher, who has personally experienced, together with other participants, the use of computers in education, conducts the research. In this regard, Mouton and Marais (1990:162) explain that the qualitative researcher is a subjective person involved with events or phenomena.

- Qualitative researchers are interested in the meaning of human behaviour and experience (Mason 1997:19). In this study I was interested in the behaviour of learners in the use of computers in education (as behaviour could be used to infer proficiency or incompetence).

1.5.2 Research method

The research method used to collect this study was primarily that of a case study

In Creswell's view (1994:12) a case study is a method in which the researcher explores a single entity or phenomenon the ('case') bounded by time and activity. Denscombe (1998:30) describes this very specific focus as a 'spotlight on one instance'. I used a selected school in the Rustenburg district to collect detailed information. Using data collection procedures over a sustainable time, to investigate the problems connected with integrating computers in schools.

1.5.3 Data collecting techniques

This study made use of five different data collecting techniques.

1.5.3.1 Focus group interview

I employed the focus group interview to uncover feelings; direct quotations from people about their experiences; knowledge and opinions; and to elicit responses to proposed solutions. The focus group interview was held in a non-threatening, comfortable setting, as it lasted for about an hour. An audio recorder was used to record a group of learners.

According to Mason (1997:15) the use of a tape recorder should not disrupt or inhibit the social process. Notes were taken judiciously during each interview.

The focus group interview involved 6 learners with similar characteristics, and similar relationships to the topic. The interviews with an individual learner and with the teacher were similarly recorded. A transcript of the conversations was made.

1.5.3.2 Individual interviews

An audio recorder was used to record the learner and teacher participants. As in the group session, notes were taken judiciously during the interview, and the audio recorder was introduced in such a way that it did not disrupt or inhibit the social process. I transcribed and analysed the audio recordings subsequent to the interview.

I maintained neutrality as explained by Mason (1997:14), when communicating with the participants. At the end of the interview I asked the participants to complete a questionnaire.

1.5.3.3 Questionnaires

At the end of the lesson six learners completed a questionnaire that was aimed at determining their level of computer awareness, exposure to computers and their computer skills. Students were not tested for competency in computer skills; they were required simply to assess their level of computer awareness and skills. The aim of this questionnaire was to contribute to a profile of prior computer-related experience of the students. An attempt will be made to compare the student profile to measures of acceptance of computer-based education.

1.5.3.4 Observation

In this study, by observation, I acquired data concerning detailed descriptions of learners' activities, behaviours, actions, and the full range of interpersonal interactions and organisational processes that were part of observable human experiences, all this took place in a natural setting i.e. the classroom during class time.

1.5.3.5 Written documents

To document the research process and progress in as much detail as possible, I kept ethnographic field notes of all major contacts with the research site. The field notes consist of as close to verbatim as possible descriptions of events. To protect the participants' confidentiality, all names will be deleted from the transcripts and code numbers will be inserted.

For example, field notes were first reviewed for paragraphs relevant to the topic of interest; next, the key content was restated in the margin of each paragraph (in vivo coding) using the same words as they appear in the text. According to Bryman and Burgess (1999:140), the data for qualitative analysis come from fieldwork.

1.5.4 Data analysis methods

Qualitative research is concerned with meanings and the way that people understand things, and a concern with patterns of behaviour. It is important to note, however, that the process of data analysis is eclectic, in other words, there is no 'right way' of analysing data. Transcribing the audio recordings and analysing them with the written dialogues did data analysis. Observations were also taken into consideration.

The first step was to read through each individual transcript and the written dialogues, as well as to listen to the actual audio recording to get a picture of the whole. During open coding, comparisons were made and questions asked. The second step repeated the first step but underlined individual behaviour patterns, which were identified. The most descriptive word for the identified shortcomings was sought and placed into categories and sub-categories. Finally field notes were used to make inferences on behaviour pertaining to the categories and sub-categories. (Tesch, 1990:56). According to Creswell (1999:158), this genuine product is a result of triangulation, or the finding of congruence, among sources of information.

1.6 ORGANISATION OF THE MINI-DISSERTATION

In this initial chapter, a background to the study was provided, and the problem statement and research question given. These identified the aim and objectives of the study. An overview of the research design of this study is provided, which will be explored in detail in chapter three. Chapter two is a review of the available literature on the subject of the use of computers in education. It presents a rationale for the use of computers in education with both the benefits and limitations thereof. The literature review examines the pedagogical aspects of the subject, and chapter two concludes with a checklist for integrating computerisation in the educational setting, derived from the literature.

Chapter three expands on the research design, and discusses the techniques, the instruments, and the methods in detail. A discussion of the results of the study takes place in chapter four, consisting of reports and the analysis of the data obtained in interviews, from questionnaires and by observation. Finally, in chapter five, there is a summary of this study, together with its findings and recommendations.

1.7 SUMMARY

This chapter served as the orientation of this research study. The following were established: the rationale was identified, the research problem was formulated that led to the aim and objectives of the research. Finally the research designs were described, and the organisation of the dissertation was set out. Chapter two consists of a review of the literature pertaining to the integration of computers in the educational environment.

CHAPTER 2

AN OVERVIEW OF LITERATURE RELATED TO THE USE OF COMPUTERS IN EDUCATION

2.1 INTRODUCTION

In education, computers are often associated with computer-assisted learning packages, which are generally delivered in a stand-alone mode in open or resource-based learning centres. The educational community is beginning to see a wider use for computers in teaching and learning: as a delivery medium for resources; as a communication medium for collaborative learning; and as a tool using traditional software packages. Computers open up new possibilities for individualising instruction; for teaching diagnostically; and for providing a real school situation for the scientific study of learning (Levy, 1998:435). The aim of this chapter is to create a theoretical frame of reference, based in the literature dealing with the use of computers in education.

2.2 THE RATIONALE FOR THE INTEGRATION OF COMPUTERS IN EDUCATION

While IT has already had a significant impact on education, I believe that its potential to enhance teaching and learning is not yet fully realised. To encourage insight into the potential of computers to enhance teaching and learning, teachers need appropriate education that would also assist them to implement good teaching practices using information technology in educational environments.

The following are often offered as reasons for using computers in education.

- *Computers improve both teaching and learner achievement*

One of the big contributions of the computer is the opportunity for children to experience the thrill of pursuing knowledge they really want. Working with computers – particularly using the Internet – intensifies valuable links between learners and teachers, other schools and students, and a wide network of professionals around the globe. Those connections spice the school day with a sense of real-world relevance, and broaden the educational community (Papert,

1980:23)

- *Computers accelerate children's development, mainly intellectually*

Papert (1980:23) said "I began to see how children who had learned how to program a computer could use very concrete computer models to think about thinking and to learn about learning and in doing so, enhance their power as psychologists, and epistemologists." Using computers helps learners to gear themselves up; developing some social and moral kinds of thinking. Most important of all in my view is that children will develop their sense of self and control. For instance, they will begin to learn what it is like to control their own intellectual activity.

- *Computers are good tools for learning*

One of the reasons computers seems to be excellent tools for learning is the attraction they exercise upon learners. In the first instance, the multi-media effects, such as fascinating pictures, sound and animation, attract users. In the second, by an excitement similar to that felt when playing a video game: the setting is perfectly, mathematically defined, and the user feels the power of completely dominating the machine, thus enhancing creative and critical thinking due to the fact that the machine presents and the learner responds and feedback is given immediately (Papert, 1980:23).

2.2.1 Benefits of computers in education

There are several benefits arising from the use of computers in education.

2.2.1.1 Computers offer high levels of interaction

According to Rushby (1996:118), the most important reason is that the computer is interactive; unlike books, tapes, films, radio and television, the user's response determines what happens next. This gives children a sense of control. Interaction refers to the active exchange of information between the computer and the student. The computer presents, and the learner responds. The computer then determines its course of action based on the learner's response and the process repeats again.

2.2.1.2 Computers can overcome the limitations of human frustration

Computers have infinite patience. A computer does not care how slowly the user responds or how often a user makes mistakes. Computers are unable to experience frustration because they do not have feelings: unlike teachers, they do not become frustrated when students experience difficulty. Whether the programme is presented once or twenty times, the tenor of the instruction remains consistent. Because the computer cannot help but maintain composure, it does not become sarcastic or bitter or do things that damage the student's self-image (Rushby, 1996:128).

2.2.1.3 Computers may provide for more humane interaction

Computers can provide privacy. Children, or for that matter teachers, can make embarrassing mistakes without anyone seeing them. Ignorance, lack of skill, slowness to comprehend, poor co-ordination, can be overcome in the privacy of one's home. The computer will not tell everyone what mistakes a learner has made, as a teacher might do (Rushby, 1996:109).

Familiarising learners with workplace technologies – by ensuring coordination of technology choices from school and to work – can greatly strengthen the transition from school to work. Employability is an important concern for all students, and experience with a technology that has high transferability to the community and workplace is crucial.

According to Bates (1995:137), the rapidly accelerating technological advances of recent years have changed our society. Computer-based education has developed alongside other facets of information technology, aided by the momentum of the World Wide Web (WWW) and other Internet services.

Students need to be taught in a way, which will enable them to become lifelong learners, able to take advantage of new technologies of the future. There is no doubt that if the deficiencies in integration of computers in education are curbed, computers will have a '*knock on*' effect on the rest of the curriculum.

2.3 LIMITATIONS OF USING COMPUTERS IN EDUCATION

Bates (1995:201) points out that a great deal of computer-based material (even, or especially, multimedia) is very poorly designed from an educational standpoint. Designing good quality educational courseware needs a high level of instructional design skills and a team approach. People with these skills are rare, and the organisational changes required are beyond the will or capacity of many institutions. Often the software comprises of short, self-contained lessons created by non-educators. This may lead to unintended results.

2.3.1 Access and resources

Many students do not have the equipment to access computer-based materials. In the foreseeable future, it is not expected that most students will be able to use educational software, multi-media programmes in particular, at home, and possibly not at school either. While vision is focused on obtaining technology hardware and software, little attention is given to changing learning strategies. The amount and quality of collaboration is highly dependent on the design of the software (Folley, 1995:132). Another aspect of the use of computers as a delivery medium is that whereas a textbook may be used at any time or place, computer-based lessons are not easily accessible for subsequent study without appropriate equipment, making it difficult to revise prior to a test or examination.

2.3.2 Cost of using computers

Bates (1995:123) points out that although the cost of development is reducing, it is still high, and there is still a shortage of good quality, off-the-shelf courseware. Development of original, high-quality computer-based learning material is expensive and requires highly skilled designers, if more than drill and practice techniques, or simple memorisation principles, are required.

Many educators believe that computers will save them money, because they will not have to distribute paper-based material. The reality of the situation, however, is that the major disadvantage of the use of computers in education is the requirement of specialised equipment, called hardware, which is expensive. Distributing the cost of this equipment to the students may cause resentment

(McCormack & Jones, 1998:24).

2.3.3 Poor teaching strategies using computers

The use of computers as a delivery medium has been widely criticised as incorporating poor teaching strategies. Van der Brande (1993:23) claims that 'only 3 per cent of educational software has been written in the context of an articulated pedagogical rationale. There is often a heavy emphasis on drill and practice and learners are often restricted to a limited range of responses (multiple-choice questions, requiring one key-stroke, or individual key-words).

The emphasis has been mainly on comprehension and memorisation of facts and principles. The computer has not proved an easy medium for developing the higher level learning skills of analysis, synthesis, evaluation, or problem solving, where there are no fixed rules or procedures (Bates 1995:192).

2.3.4 The inability of computers to respond spontaneously

Hannafin and Peck (1988:35) claim that teachers can react instantaneously from a complex base of knowledge and accrued wisdom based on years of experience. While they can react appropriately to new experiences drawing on similar events and on rules learned in other contexts, the computer only 'knows' what the programmer has been able to anticipate will be necessary in the educational environment.

2.4 THE USE OF COMPUTERS IN EDUCATION

The integration of computers in education refers to the use of computers in education to help people learn. It includes educational programmes that people can run on their personal computer: lessons they can take where they want, when they want. Computer-based education (CBE) is a collective term that may be used for computer-assisted instruction (CAI), computer-managed instruction (CMI), computer-based training (CBT) and computer-based learning (CBL). In order to fully understand the integration of computers in education, it is necessary to examine each of these applications. The applications may refer either to stand-alone computer learning activities or to computer-supported activities,

which reinforce material introduced and taught by teachers.

2.4.1 Teaching and learning applications

The following are some of the categories of computer-assisted instruction (CAI), each of which is appropriate under different instructional circumstances and therefore takes a different pedagogical approach. The types of computer-assisted instructions (CAI) are as follows:

2.4.1.1 Drill and practice

Drill and practice refers to a type of CAI that uses a learning methodology to reinforce familiar knowledge. According to Forcier (1996:241) teachers use drill and practice to reinforce instruction by providing the repetition necessary to acquire skills and concepts or to refine a particular skill or concept. Roblyer, Edwards and Havriluk (1997:86), however, believe that drill and practice activities provide exercises in which students do example items, usually one at a time, and receive feedback on their correctness.

Programmes vary considerably in the kind of feedback they provide in response to student input, ranging from a simple display like "OK" or "No, try again" to elaborate animated displays or verbal explanations. Some programs simply present the next item if the student answers correctly.

Well-designed drill and practice programs should meet the following criteria:

- *Control over the presentation*: students should have as much time as they wish to answer a question and examine the feedback before proceeding to subsequent questions.

- *Appropriate feedback for correct answer*: Positive feedback should not be so elaborate and time-consuming to display that it detracts from the lesson purpose. Some programs inadvertently motivate students to get wrong answers. This happens when a program gives more exiting or interesting feedback for wrong answers than for correct answers.

Drill and practice programs are frequently criticised because the feedback

responses give no direct information as to why a response was incorrect. Feedback is often restricted to either the presentation of the right answer or a brief message such as 'correct'.

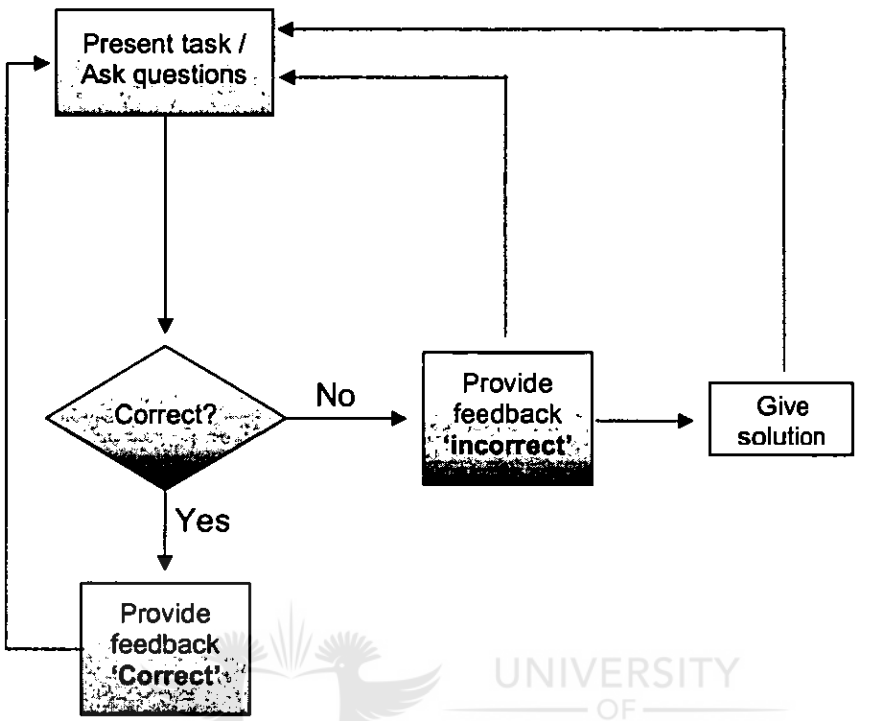

FIGURE 2.1: A prototype of drill and practice (adapted from Harrison 1997:76)

2.4.1.2 Tutorials

According to Poole (1998:157), drill and practice software is designed to reinforce known skills, whereas tutorial software is designed to introduce the learner to new skills. A simple, linear tutorial gives the same instructional sequence of explanation, practice, and feedback to all learners regardless of differences in their performance. A good tutorial presents the goal up front; is enjoyable; thorough; sensitive to the user's capabilities; and provides immediate and appropriate feedback. Interactivity is key to user involvement and perseverance

The principal advantage of linear designs is the capacity to maintain control over the sequence of the instruction. A more sophisticated, branching tutorial directs learners along alternate paths depending on how they respond to questions and whether or not they show mastery of certain parts of the material. Even branching tutorials can range in complexity by the amount of branching they allow

and how fully they diagnose the kinds of instruction that a student needs.

Well-designed tutorial programs should also meet several additional standards:

- *Extensive interactivity*: Good tutorials, like good teachers, should require students to give frequent and thoughtful responses to questions and problems, and they should supply appropriate practice and feedback to guide students' learning

- *User control*: User control refers to several aspects of the program. Students should always be able to control the rate at which the text appears on the screen; the user should be allowed to go on the next activity by pressing a key; the program should give the user the opportunity to review explanations or examples; and lastly the program should provide frequent opportunities to 'continue' or 'quit' as desired.

- *Appropriate and comprehensive teaching sequence*: The program's structure should provide a suggested or required sequence of instruction that builds on concepts and covers the content adequately; it should provide sufficient explanations and examples.

2.4.1.3 Simulations

Simulations differ from tutorial and drill practice activities by providing less structured and more learner-directed learning activities. The user usually chooses tasks, and the order in which to do them. Alessi and Trollip (1994:119) identify two main types of simulations: "those that teach about something and those that teach how to do something". They further divide the "about" simulations into physical and process types, and they divide the "how to" simulations into procedural and situational types. Using simulations, the students learn the correct steps in the procedure.

- *Physical simulations*: Users manipulate objects or phenomena represented on the screen.

- *Process simulations*: These speed up or slow down processes that

usually either take so long or happen so quickly that students could not ordinarily see the events unfold.

- *Procedural simulations*: These activities teach the appropriate sequence of steps to perform certain procedures. They include diagnostic programs.

- *Situational simulations*: These programs give students hypothetical problem situations and ask them to react. Some simulations allow for various successful strategies, others have most desirable and least desirable options, such as choices when encountering a potentially volatile classroom situation.

According to Forcier (1996:246) simulation is another honoured teaching strategy used to reinforce instruction by providing an environment for discovery learning to take place or for newly acquired skills and concepts to be tested. Simulations can present a sample of a real situation and can offer genuine practice at solving real problems unhampered by danger, distance, time, or cost factors.

2.4.1.4 Integrated learning systems (ILS)

Integrated learning systems are computer-based systems for the delivery of curriculum material via an individualised program of study. An ILS is made up of two components: CAI modules (often called courseware) and a management system. The key features are:

- *Each pupil has an individualised learning program*: If they perform well, they can rapidly progress to higher levels of difficulty. If they experience problems, they are given more practice and may also be given additional tutorial and support questions on the various skills needed to deal with a particular topic.

- *Teachers have access to data for monitoring pupil's progress*: This will highlight pupils who are experiencing difficulty and who are in need of additional support. This data is gathered automatically and can be printed out in a series of different reports.

- *The management system constantly monitors pupil performance*: Success Maker, a program designed to monitor learner progress, then takes remedial action, whenever this is appropriate; pupils get immediate feedback after every question. This can raise motivation and accelerate learning.

2.4.1.5 Word processing

The word processor is software that accompanies almost any computer system today and it can be the most effective example of CAI. According to Poole, (1998:146) the word processor is the most fundamental of all computer applications; it is a tool for learning which inevitably revolutionises the teaching of writing in elementary and secondary schools where computers are made available to all students. Forcier (1996:14) states that the word processor allows the students to express ideas and, with the teacher's guidance, refine the quality of that expression with a reasonable amount of effort in a short period of time.

Children prefer writing at a computer because of the ease of text modification and because of the improved appearance of the final product. The net result of this is that the children are motivated to write more, and this alone leads to improve writing skills, especially when they are working with teachers who provide that 'prepared environment' in which spontaneous intellectual growth can flourish.

Not only are the children more likely to become better writers using a word processor; they are also more likely to blossom in all areas of academic life. As a bonus, writing skills are also likely to improve through use. Writing should be an integral part of any instructional programme. It is unfortunate that, outside the English classroom, most teachers in a selected school in the Rustenburg district provide only limited writing opportunities.

2.4.1.6 Database management

Poole (1998:149) explains that a database package is designed to help the user create files containing perhaps thousands of records, capture the data, store it on disk, rearrange it, sort it on specific fields, select subsets of records and of fields within records, and produce reports. A database is able to handle any character-

based data, whether text or numbers. Although modern databases are designed to carry out mathematical operations on numbers, for most part, the database is best at handling data as plain text.

2.4.1.7 Spreadsheets

A spreadsheet, like a database, is a powerful tool for gathering data, manipulating it, and presenting it in various ways (Poole, 1998:149). According to Forcier (1996:80), the idea of a computer spreadsheet arose from the observation that much of the numerical work done by adults in our society was done with a pencil, eraser, and paper. Typically, these tools were used to arrange numerical data into an organised set of rows and columns. Of course, the contents of these rows and columns would vary according to the task at hand.

For teachers, the rows might contain student names, and the columns, student grades on different assignments. At home, the rows might be items in a family budget, and the columns, expenditures for different days, weeks, or months. Work with spreadsheets also gives students practice categorising numerical data. When setting up a spreadsheet system, students must decide how to divide the data into meaningful categories.

Ease and efficiency of calculation are other advantages of using a spreadsheet for grade records. Once the template is set up, totals and percentages are automatically updated each time a new score is added. Average scores for individual tests and other statistics can be calculated as soon as the data for a test are entered. Spreadsheets provide an ideal environment for students to apply concepts about functions and formulas. In creating a template for a spreadsheet, students must work out formulae that express the relationships between the values in the spreadsheet.

2.4.1.8 Graphics

Graphics are used in almost every application to improve the appearance of assignments and projects, to explain concepts, to identify products, etc. Most application software packages today have a drawing component that includes tools for easy manipulation of shapes, shades, colours, and text. Where teachers

have the technology available in their classrooms, they can give students the opportunity for enriching learning experiences. Individual or team projects can result in portfolios, which include the development and sharing of multimedia presentations using tools such as those described above.

2.4.1.9 Communications

Poole (1998:154) advocates that a computer, a telephone, and a modem are all that are necessary to connect a student with the rest of the world. Strictly speaking, a telephone can be a useful tool for teaching since it puts students in touch with students elsewhere and also acts as a vital link between the school and the home, but when a modem is used to connect a computer to the telephone system, interesting educational opportunities open up. The students are being afforded the opportunity for cross-cultural interaction over telephone networks with students in other communities at home and abroad. Computers and communication technology is thus extending a student's educational experience provided to it in order for it to perform specific tasks.

2.4.2 Teaching computer skills

Included here are skills and knowledge related to technology that are part of the technology curriculum.

- Teaching about computers
- Computer skills
- Computer literacy

Computer technology is the buzzword of the 21st century. Its effective teaching will give the learner the opportunity to become a proficient computer user who can eventually help himself in an economic environment. This implies that the learner must know how to use the computer and the relevant software constructively and creatively. Computer skills are a prerequisite for computer literacy: they prepare students to use technology for work and personal use, for accessing and applying information, for problem solving, and for communicating via e-mail or chat and newsgroup. There are three major goals for a computer

skills curriculum according to North Carolina Public Schools, (2001 [online])

- The first goal requires students to understand the important issues of a technology-based society and to exhibit ethical behaviour in the use of computer technology.

- The second requires students to demonstrate knowledge and skills in using computer technology.

- The third goal requires students to use a variety of computer technologies to access, analyse, interpret, synthesise, apply and communicate information.

The advent of computer technology has brought dramatic changes in the way people communicate, learn, play, do business, and solve problems. Mecoamere (2002:2) quotes Minister Asmal as saying, "an information society is not simply about people using Information Communication Technology (ICT), it is about people who address common social and economic problems using ICT, and it involves more than technical solution." Forcier, (1996:8) explains that the study of computer literacy focuses on the computer as the object of instruction. In computer literacy, the scope and sequence of curriculum goals is usually developed within a school district that specifies what is to be learned about the functional use of the computer, and about its role in society. Computer literacy means learning fundamental computer concepts and application programmes; it also means recognising both the positive and negative consequences of computers in our society.

One definition of computer literacy centres on a child's familiarity, comfort, and facility with a computer, its peripherals, and a wide variety of software programmes. According to Kalme (1998: [online]), computer literacy involves the following components:

- Introduction to PC's.

- What is a PC?

- Which are output and input devices?

- Operating systems.
- Application programs: Word processing, Spreadsheets, Database, and PowerPoint form the core programs that enable the student to do rudimentary Desktop Publishing.
- Multimedia: the emphasis is on using CD-ROM's for educational games.

Computer literacy often examines the history of computing, and computer awareness and functional use as well as the broader role of the computer as it relates to societal issues such as computer access, gender relationships, software copyright, and rights of privacy, data security, and information ownership according to May and Waters, (2001 [online]).

2.4.3 Educational management

According to Shelly et al (1999:6.16), the best way to manage technology is to put technology into the hands of trained teachers, make it easily accessible, and let them decide how best to use it in the classrooms at the point of instruction and administration. Forcier (1996:4) states that the management category includes school and classroom applications in budgeting, accounting, record keeping, printed and electronic communication, and information retrieval. CMI stresses the management of student performance in a direct on-line approach (with the student working directly at the computer) or in an off-line approach (Forcier, 1996:11).

Shelly et al (1999:3.24) say that many schools are undergoing a period of transition relating to student record maintenance and the storage of other pertinent information. An important key factor driving this transition is the installation of networks: many school districts are networking all of their laboratories into local and wide area networks. Having networks in schools allows schools to manage and maintain information on students and teachers in various ways. Schools that have networked computers are installing school and student management software. When standardised throughout the school district, these programs can dramatically improve a school's capability of managing and analysing daily operations, budgets, and student information.

2.4.4 Research

According to Forcier (1996:18), educational research includes functions relating to information gathering and processing. The researcher/teacher may examine student performance data in new and revealing ways, including statistical analysis, bibliographic searches, and data retrieval.

2.5 PEDAGOGICAL ASPECTS

Pedagogy is defined as the art, science, or profession of teaching. Bronack and Riedl (1998:165) suggest that a person's pedagogy embodies the beliefs held about students, the attributes of the media technologies and essential qualities of the relevant content. Pedagogy can be described as all of those strategies and methods that a teacher uses to ensure that his teaching is successful.

Pedagogical dimensions of computing refer to the capabilities of computers to initiate powerful instructional interactions, monitor learner progress, empower effective teachers, accommodate individual differences, or promote cooperative learning. The computer as an educational tool will be programmed in such a manner that it presents a focal event or problem situation to serve as an anchor or focus for collaborative efforts among teachers and learners to retrieve and construct knowledge. Problems and events presented by computers will be designed to be intrinsically interesting, problem-oriented, and challenging. In response to these types of events and problems, learners would construct useful (as opposed to inert) knowledge.

2.5.1 Strategies for teaching with the computer

The best strategy for integrating computers in education is to put the computers into the hands of skilled teachers, make them easily accessible, and let the teachers decide how best to use the computers in education. Teachers then can use an assortment of teaching strategies to develop a learning environment in which learners are encouraged to be independent and take responsibility for their own learning. Another strategy is to plan for the use and integration of computers in education. Just as planning is essential to effective instruction, it is also required for the effective use and integration of computers in education.

Teachers must plan. In their planning they must consider the environment to which they are going to expose the learner. When teachers use forty computers to teach learners, they must plan how and when they will use those computers, the software they will use, how they will enable their learners to use those computers, and how will they motivate their learners to overcome fear of the machine. A third strategy for teachers is to evaluate the appropriateness and effectiveness of the educational technology to see if it enhances the teaching and learning process.

Van der Horst and McDonald (1997:124) define teaching strategy as a broad plan of action for teaching activities with a view to achieving an aim. To develop a concept by using direct instruction is a strategy. The most apparent strategies are the inductive and deductive approaches. The principles underlying these two strategies are fundamental, and they form the basis of all contemporary approaches in teaching. According to Forcier (1996:240), drill and practice, tutorial instruction, and simulation are indeed time-tested instructional strategies; they are strategies that behaviourists can apply in the teacher-centred instructional situation and that constructivists can apply in a student-centred learning environment, depending on how they are employed. They are strategies that gain attention, stimulate recall of prior learning and present new information in ways that approximate real-life situation at a more concrete level than most media used in the classroom.

2.5.2 Interaction in CBE environments

Computer lessons should be interactive. One of the computer's salient features is its ability to involve the learners; interaction may contribute to learning in several ways:

- Interaction assures that messages are received and that critical attributes of the lesson are attended to. Unlike lectures, videotapes, and most other media, a computerised lesson generally requires frequent responses from the learner to control lesson execution (Reeves, 2000 [online]). When the student's mind wanders, the computer patiently waits (unless it has been programmed to regain the student's attention after a lengthy pause):

information need not be presented to an inattentive audience. In addition, the computer can frequently query students and monitor responses to ascertain that the student has received and processed the intended educational message.

- Interaction (Bates, 1995:128) encourages responses to strengthen cognitive ties and facilitate recall of the response. When a student physically responds to a question or demonstrates a desired behaviour within the context of a lesson, the act of responding may itself be remembered, providing an additional method by which the desired learning may be recalled.

- According to Bates (1995:128), interaction allows for remediation of incorrect responses. Interaction between the computer and the learner allows computer programs to identify and remedy incorrect learning and to identify misconceptions so they do not endure in place of the desired learning outcome.

- Interaction increases academic learning time. Learners are willing to spend more time with CAI than learners employing more traditional educational media (Hannafin & Peck 1988:51). Interaction, by definition, requires learner involvement. This involvement may lead to feelings that the learner controls instruction, which may, in turn, be responsible for the willingness to spend more time with CBE lessons.There are different types of learner interaction in the CBE environment. While interaction is as essential in CBE as it is for any other kind of teaching, computers, in fact, offer wider opportunities and make stronger demands on learners' interaction than other types of interaction. Alden (1998:33) distinguishes between the following types of interaction:

- *Learners interacting with materials*: The learners interact with computer-based material. Questions and answers are available to the learner without any need for the intervention of a teacher/facilitator.

- *Learners interacting with other learners:* Learners can work together on

projects or in the same group exercises in private, or be monitored by the teacher. An example of this type of interaction is when learners work in pairs or small groups engaged in a brainstorming session about the course content.

- *Learners interacting with subject matter experts:* In this situation learners gain a different perspective, based on the expert's special experience. It is equivalent to having a quest speaker in the traditional classroom.

2.5.3 Motivation

According to Cornell and Martin (1997:93) motivation is a hypothetical construct that refers to those internal and external conditions that influence the arousal, direction and maintenance of behaviour. Motivation is considered to be a primary factor in learning, and can be triggered by extrinsic or intrinsic factors (Reeves & Reeves, 1997:61). Lockard, Abrams and Many (1998:182) explain that motivation is an essential element in instruction and that it enhances persistence on the part of learners which improves learning and problem-solving abilities. It is acknowledged that learning will be more meaningful if motivation is intrinsic to the user.

2.6 INTEGRATION CHECKLIST

The criteria for integration of computers in education are derived from the literature review and are represented by Table 2.1. The literature study yielded the following checklist;

Mark the observation that comes closest to the integration of computers in education with a cross	YES	NO
1 The use of Computers in education (Computer applications)		
- Drill and practice		
- Simulations		
- Tutorials		
- Integrated Learning Systems (ILS)		
- Word Processor		
- Spreadsheet		
- Graphics		
- Database Management		
- Communications		
2. Teaching computer skills		
- Computer literacy		
- Computer awareness		
3. Pedagogical aspects		
(i) Motivation		
- Intrinsic		
- Extrinsic		
(ii) Teaching-Learning strategies		
- Planning		
- Skilled teachers		
- Evaluate		
(iii) Interaction		
- Learners interact with learning material		
- Learners interacting with other learners		
- Learners interacting with the facilitator		
- Interaction allows for remediation of incorrect responses		
4. Networks		
- Local area network (LAN)		
- Wide area network (WAN)		

5. Management, includes		
- Student performance		
- Record-keeping		
- School's budget		
- Student information		

Table 2.1: Integration checklist

2.7 SUMMARY

This chapter reviewed the literature study undertaken on the use of computers in education. From the study, the rationale for the use of computers in education was highlighted; the benefits and limitations of computers in education were set out; computer applications, computer literacy, motivation, management, research and teaching-learning strategies were discussed. Chapter three will give details of the research design carried out.

CHAPTER 3

THE RESEARCH DESIGN OF THE STUDY

3.1 INTRODUCTION

This chapter describes the research design, which was followed in order to gather, record and analyse data in this study. An overview of the theory of research in technology and education is first given to provide a theoretical framework for research methods and techniques within this particular field. This study depends on qualitative methods of data collection. The case study, which may generally be regarded as a mixed-method study (Reeves, 2000: [online]), combines a variety of techniques, mostly quantitative and qualitative, including questionnaires, direct observation, focus group interviews and individual interviews.

The procedure for a study of this nature includes the indication of a specific type of design; reflects on my role as the researcher; discusses data collection and the recording of data; and concludes with the data analysis procedures. This chapter also includes a description of the implementation of computer-based education in a selected school in the Rustenburg district.

3.2 RESEARCH DESIGN

The research design has its origins in the nature of the research problem, which is systematically investigated and reflects a series of major decisions I made in an attempt to discover the best approach to the research question in order to answer it. The aim of a research design is the planning and structuring of a given research project in such a manner that the eventual validity of the research findings is maximised (Mouton & Marais, 1994:33). According to LeCompte and Preissle (1993:55), the research design involves putting things together, and bringing to consciousness and to notebook as many aspects of the research planning and preparation for an enquiry as possible.

The research design of this research study is based on a qualitative research approach and, as such, is descriptive, explanatory/exploratory and contextual

(Mouton & Marais 1994:43).

Descriptive research design aims to provide the researcher with accurate and detailed information about a phenomenon. The design, just like exploratory design, relies on particular forms of data collection that will be used in this study. These are observation, questionnaires and interviews (Bless & Higson-Smith, 2000:105). There is no manipulation in the treatment of subjects; I took things as they are. I will give a description of how a selected school in the Rustenburg district adheres to the overview use of computers in education.

Explorative research aims at the exploration of a relatively unknown research area. The context of this study, integrating computers in education in a school, can be considered a relatively unknown field of study in this regard. According to Bless and Higson-Smith (2000:43) exploratory research is used to gain insight into a situation, a phenomenon, a community or a person. The need for this type of study arises from the lack of basic information on the problems of integrating computers in education in a selected school.

Contextual research aims at studying the phenomena because of their intrinsic and immediate contextual significance (Mouton, 1996:133). A study having contextual interest is bound to the unique context of the domain phenomenon (Mouton & Marais, 1990:50) and so my role was to gain a holistic overview of the context under study: its logic, its arrangements, and its activities (Miles & Huberman, 1994:6).

Qualitative research is a field of inquiry in its own right; crosscutting disciplines, fields and subject matters (Denzin & Lincoln, 2000:2). It is inherently diverse in focus, using multiple methods, or triangulation. According to Flick (1998:229), qualitative research reflects in an attempt to secure an in-depth understanding of the phenomenon in question. By its nature, qualitative research never captures objective reality. People can know a thing only through its representation.

Denzin and Lincoln (2000:7) define qualitative research as a broad, interpretative, post experimental, post modern, feminist and critical sensibility. More narrowly, they define it as positivist, post positivist, humanistic and naturalistic conceptions of human experience and its analysis. Qualitative research seeks answers to

questions that stress *how* social experience is created and given meaning (Denzin & Lincoln, 2000: 8). There have been many ground-breaking and exemplary studies focusing on the role of computing in education, but Selwyn (2000:94) identified the need for more qualitative studies.

The following characteristics typify this study as qualitative research:

- The study is conducted in a natural setting (Creswell, 1994:162). Within the context, the participants (Grade 10 learners and their teacher) were directly observed, enabling the description of participants and their conversations.
- I studied the phenomenon as an outsider to assess the use of computers in education in this school.
- A small group of 6 participants consisting of two girls and four boys, as well as one teacher, participated in the individual and focus group interviews.
- In this study I focused on the behaviour of learners in the computer classroom, as behaviour could be used to infer proficiencies or incompetencies.
- The data that was collected was not analysed by any statistical, quantitative method (Strauss & Corbin, 1990:17), but rather by means of qualitative methods.

According to (Selwyn, 2000:95) the demand for a more qualitative approach to educational computing research is due to the fact that educational technology, thus far, has remained impervious to qualitative methodology and analysis. Although an explicit reliance on qualitative methods is as constricting as a purely quantitative approach, the analysis of a qualitative dimension allows a focus on what actually happens (as opposed to what apparently has happened or what might happen) when computers are used in education.

A combination of qualitative and quantitative methods as recommended by LeCompte and Preissle (1993:32) and Reeves (2000: [online]) will be used in this

case study to assess the integration of the computer in education and to determine the experiences of learners of computer-based education.

Figure 3.1 illustrates the research design of the study.

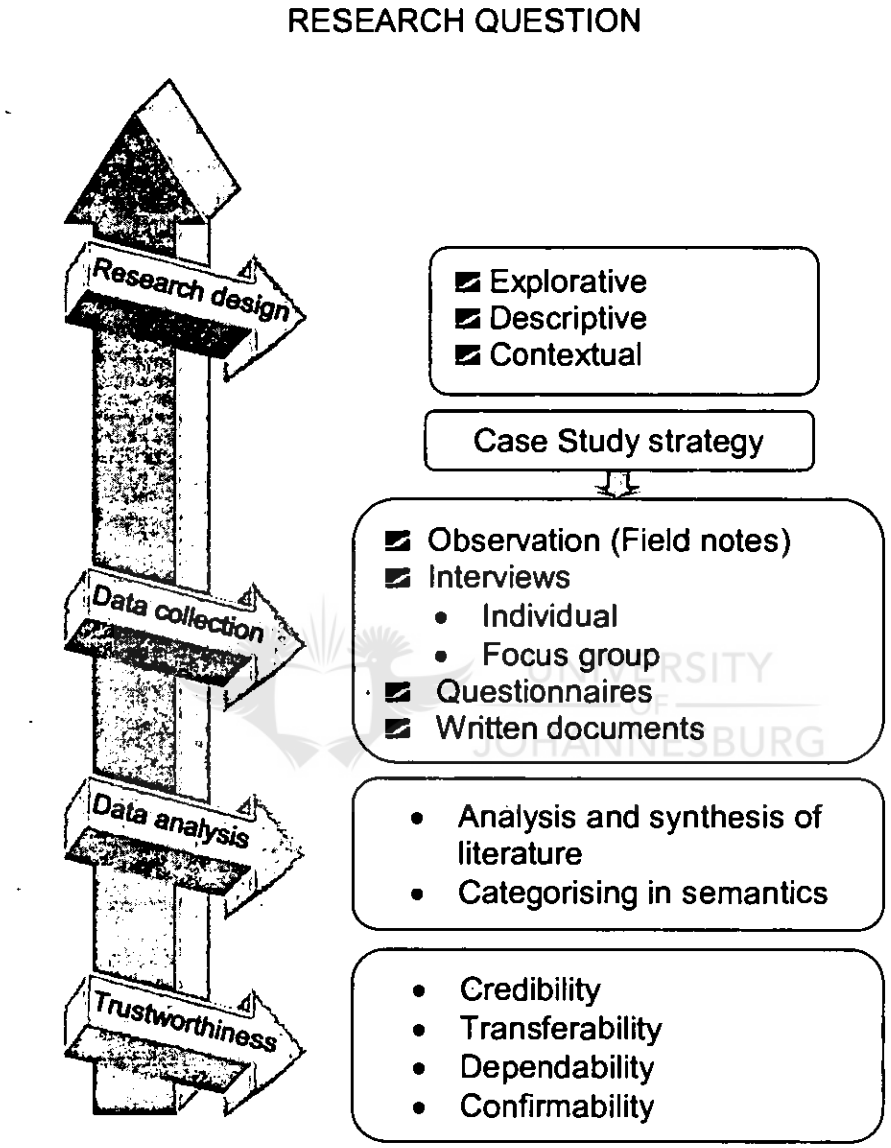

FIGURE 3.1: Schematic representation of the research design

3.3 RESEARCH METHOD

The research method used to conduct this study was primarily a case study. Whereas some classify 'the case' as an object of study, McMillan and Schumacher (2001:36) consider it a methodology: a case study examines a 'bounded system' or a case in detail over time, employing multiple sources of

data found in the setting. The case may be a programme, an event, an activity, or a set of individuals bounded in time and place.

The research methodology employed in the study was interpretive and endeavoured to make sense of the background of two of the classes taught functional computing and computer studies from the actions of the participants (i.e. the teacher and the learners). The interviewees were nominated by their reputation, for example the 'best' learner or teacher. The interviewees were six learners from grade ten classes who studied both computer studies and functional computing, those who appeared from their behaviour and actions to be motivated by the use of computers in education. According to McMillan and Schumacher (2001:403) a 'case' refers to an in-depth analysis of a phenomenon and not the number of people sampled.

The study aimed to make sense of the actions of the participants by describing their behaviour and linking it to what they learned and how they constructed the various contexts in which they were taught. The use of a case study provides an in-depth account of learners' experiences of using computers in education, rather than a general view (Denscombe, 1998:30).

3.4 METHODS OF DATA COLLECTION USED IN THIS STUDY

The format of this study depended on multimethod strategies: the use of multiple strategies to collect and corroborate the data obtained from any single strategy and/or ways to confirm data within a single strategy of data collection (McMillan & Schumacher, 2001:429). A number of data collection techniques are employed in the study.

According to Denscombe (1998:84), it is acceptable to use different techniques to collect data about the same thing, as more data became available allowing the researcher to gain multiple perspectives on the same thing.

Table 3.2 illustrates the relationship between the research questions and the data collection techniques.

RESEARCH QUESTIONS	O	FGI	I-I	Q	Lit	FN
SQ1 Theoretical frameworks for integrating computers in schools	✓			✓	✓	✓
SQ2 Deficiencies in integration attempts	✓	✓	✓	✓	✓	✓
SQ3 Integration approach to facilitate implementation		✓	✓	✓	✓	✓

Legend

SQ	=	Sub Questions relating to the research question
O	=	Observation
FGI	=	Focus group interview
I-I	=	Individual Interview
Q	=	Questionnaire
Lit	=	Literature review
FN	=	Field notes

Table 3.1: Data collection techniques used.

3.4.1 Observation

According to Denzin and Lincoln (2000: 673) observation has been characterised as the fundamental base of all research methods; even studies based on direct interviews employ observational techniques to note body language and other gestural cues that lend meaning to the words of the persons being interviewed. I observed and interacted in the natural setting for a period of one week.

I firstly got the consent of the participants observed; I remained a researcher, however, and did not cross over the line into friendship (Adler & Adler, 1999:380). A great deal of what I did during observational research was to pay attention, watch, and listen carefully, use all senses, noticing what is seen, heard, smelled, tasted, or touched. I became an instrument that absorbed all sources of information (Neuman, 2001:361). During the observation, I considered what I observed, redefining or focusing ideas about the significance (Denzin & Lincoln, 2000:36).

The observation was pursued in a systematic way, following scientific rules, in order to obtain usable and quantifiable data (Bless & Higson-Smith, 2000:103). During the observation, I observed the teacher while he used computers in the

lesson teaching a programming language called PASCAL. Direct observation of the teacher and the learners, and how they experienced the computer-based lesson, was only possible in the face-to-face class situation when certain issues regarding computer-based learning were discussed and jotted down on the whiteboard by the teacher in charge.

Field notes are written accounts made during the observation, on the spot or as soon as possible after their occurrence, that represent the interaction and activities of the researcher and the people studied (LeCompte & Preissle, 1993:224). Field notes were taken as a supportive source of data collection during the observation, to assess the extent to which computer-based education is implemented in this school.

3.4.2 Focus group interview

Fontana and Frey (1998:104) note that the focus group interview relies upon the systematic questioning of several individuals simultaneously in a formal or informal setting. On completion of the lesson, six learners took part in a focus group interview in the selected school, no sampling method was used to select informants and all learners were invited to attend. Apart from the obvious practical advantages of interviewing several learners at the same time, it is often very useful to allow participants to share their thoughts with each other (Bless & Higson-Smith, 2000:115). Exposure to new ideas, may lead participants to consider a range of views before answering questions. Interaction is a unique characteristic of a focus group and so the researcher used a focus group interview as a qualitative technique to collect data. A focus group interview was held with six grade ten learners. In the format of a semi-structured interview, a number of questions were derived from their experiences with the computer to hear their opinion about integrating computer-based education into the school curriculum. The entire interview was recorded and transcribed. A transcript of the conversation is presented in Appendix A.

Another method employed to get people to express their views was the non-scheduled interview, which consists of asking respondents to comment on broadly defined issues. Those interviewed are free to expand on the topic as

they see fit, to focus on particular aspects and to relate their own experiences. By sharing their feelings and thoughts, I 'got to know' respondents' beneath their rational facades. Informed consent was obtained before each of the interviews and pseudonyms were used to protect informants' identities. In order to protect the informant's identities, I decided not to include individual learner profiles, even though they would have helped in the understanding of this case study.

3.4.3 Individual interviews

In order to obtain more detail of certain experiences of computer-based education identified in the focus group interview, it was necessary to hold individual interviews with selected learners whom I believed could help in the process. Unfortunately, the learners were busy with examinations, so I was only able to interview one learner. This interview may be seen as an example of key informant interviewing, key informants being individuals who posses special knowledge, status or communicative skills, and who are willing to share that knowledge and skill with the researcher (LeCompte & Preissle, 1993:166).

According to LeCompte and Preissle (1993: 166), key informants are selected carefully so as to ensure a representative group. I wished to expand on data that was gathered in the focus group interview with special reference to the situation in the selected school. With this in mind, the learner was identified and selected for the interview. In this case I wanted the learner to expand on specific responses in order to gain deeper understanding about how computer is used in education. The teacher was also interviewed, and he was asked questions on teaching about the computer and teaching using a computer as a tool.

3.4.4 Questionnaires

Bless & Higson-Smith (2000:105) contends that the most structured way of getting information directly from interviewees is by means of a questionnaire. This method is based on an established set of questions with fixed wording and sequence of presentation, as well as more or less precise indications of how to answer each question. The questionnaire was presented to each interviewee (four boys and two girls, chosen because of their willingness to participate) in exactly the same way to minimise the role and influence of the interviewer and to

enable a more objective comparison of the results. Learners were requested to complete the questionnaire that focused on their exposure, awareness and access to computers, and the software most employed in the integration of computers in education. The aim of the questionnaire was to contribute to a profile of prior computer related experiences of learners.

3.5 ANALYSIS OF THE QUALITATIVE DATA

Qualitative research is often inductive (Neuman, 2000:418), making generalisations from observed data; it is less abstract than statistical analysis and closer to raw data. Qualitative data are the product of a process of interpretation. The data only become data when used as such (Denscombe, 1998:208). Data do not exist 'out there' waiting to be discovered, but are produced by the way they are interpreted and used by researchers. The focus of this section is to explain how to elicit meaning from data (LeCompte & Preissle, 1993:235). According to Creswell (1994:124) there is no 'right way' of doing this. In this section I will describe the way in which I managed and analysed data in this study.

3.5.1 The role of the self in qualitative analysis

The researcher's self plays an important role in the production and interpretation of qualitative data; and the identity, values and beliefs of the researcher cannot be entirely removed from the research process. In fact, qualitative researchers accept and acknowledge the inevitability that the researcher's self is an integral part of the data analysis (Denscombe 1998:208). To compensate for this, I attempted, as far as possible, to distance myself from personal beliefs and suspended judgement on the issues for the duration of the study.

3.5.2 Preparing data for analysis

Data were collected and a transcript of the focus group interview was prepared and typed with suitable margins for the process of analysis (Denscombe, 1998:209). Data were collected by means of interviews, observation (field notes), and questionnaires as indicated in the above paragraphs. Data collected from the record of the focus group interviews and individual interviews were

transcribed onto A4-paper, and the same procedure was used with the questionnaires. Several duplicates of the data were made so that the process of analysis may be repeated as needed (Lofland & Lofland, 1995:76).

3.5.3 Procedures for data analysis

Data analysis requires that the researcher be comfortable with the development of categories and making of comparisons and contrasts (Creswell, 1994:153). Neuman, (2001:420) advocates that a qualitative researcher analyse data by organising it into categories on the basis of themes, concepts, or similar features. During the process I developed new concepts, formulated conceptual definitions and examined the relationships among concepts.

According to Neuman (2001:420), in qualitative research ideas and evidence are mutually interdependent. This applies particularly to case study analysis. By analysing a situation, I organised data and applied ideas simultaneously to create a specific case. During the process I had to remain open to any possibilities and be aware of contrary or alternative explanations during data reduction and interpretation.

According to Miles and Huberman (1994:10), the first step in analysing qualitative data, is the process of data reduction. Data reduction refers to the process of selecting, simplifying, abstracting and focusing the data that were collected. Each piece of unprocessed data should be identified with a unique code or serial number for reference purposes. In my role as researcher, I freed myself from entanglement in the details of the raw data by coding data. Neuman (2000:420) holds that qualitative coding is an integral part of data analysis. It is guided by the research question and leads to new questions. In this study, the data that were collected were transcribed and reduced. This process yielded several categories and sub-categories, which are described in chapter 4.

3.5.4 Open Coding

The process of naming and categorising of phenomena by close analysis of the data is referred to as open coding. During open coding, comparisons are made and questions asked. During the analysis of the data, I labelled each discrete

incident, idea, event or anything that represents a phenomenon. Denscombe (1998: 211) refers to these discrete items as 'units'. Data need to be broken down into units for analysis. Units are identified by specific words, ideas or events. The procedure of breaking data into units is to identify patterns, commonalities and differences and processes' (Miles & Huberman, 1994:9).

3.6 THE LITERATURE REVIEW

According to McMillan and Schumacher (2001:134), the literature review frequently cites broad areas of scholarly thinking, such as sociological, psychological, anthropological, and political, with representative scholars, and it illustrates why certain concepts may become relevant in data collection and analysis. The purpose of the literature review is to describe and analyse naturalistic social scenes or a process without suggesting grounded theory.

LeCompte and Preissle (1993:151) state that the literature review stresses the impact of theory in every stage of the study, from the problem statement through data collection, to analysis and interpretation. Later the literature review becomes the reference point for retaining or changing the focus of the study. Creswell (1994:37) points out that the qualitative approach uses the literature inductively towards the end of the study. The literature review was used to create a theoretical frame of reference in order to assess the integration of computer in the school.

3.7 THE TRUSTWORTHINESS OF THE RESEARCH

According to Krefting (1991:214), qualitative research is evaluated too often against criteria appropriate for quantitative research. It remains important, thus, to look at qualitative methods and ways to ensure the quality of the findings. Guba's model, as described by Krefting (1991:215) identifies truth-value, applicability, consistency and neutrality as four criteria applicable to research of any type. The comparison of these criteria by research approach is seen in Table 3.2:

Criterion	Qualitative approach	Quantitative approach
Truth value	Credibility	Internal validity
Applicability	Transferability	External validity
Consistency	Dependability	Reliability
Neutrality	Confirmability	Objectivity

Table 3.2: Guba's comparison of criteria by research approach (Krefting, 1991:217)

The following paragraphs are used to describe the strategies that may be employed to ensure the trustworthiness of this study.

3.7.1 Credibility of the findings

All research is subject to questions about credibility. Miles and Huberman, (1994:262) note that researchers often 'get it wrong'; that their findings often simply do not fit the data. In conducting this research, I constantly reflected on the context, and my perceptions and interests, and how they influenced data analysis. Having done this, I was able to claim neutrality in the qualitative approach to the study. I kept a field journal with rough notes on thoughts, feelings, ideas, problems, questions and frustrations. These random observations enabled me to examine various situations from many different perspectives.

A number of participants were asked to respond to a draft of the report findings, which further improved credibility by ensuring that the final presentation of the data reflected the experiences of learners regarding computer- based education. The interview technique was another way in which credibility was enhanced.

Repetition, reframing or expansion of questions during the interviews led to the enhancement or support of previous findings, and the verification of observations and meanings. In order to carry out this research I have had to improve my degree of familiarity with educational computing programs.

Good investigative skills were developed through the literature review and improvement of my qualitative research methods.

3.7.2 Transferability of the findings

Transferability is an attribute of research that is valid when various independent research methods lead to the same findings, which can be applied to similar situations. An adequate background to the study has been provided and this allows transferability judgments to be made by other researchers in this field based on whether observed events are typical or atypical of the group being studied.

3.7.3 Dependability of the findings

Methods to ensure dependability, or what Krefting (1991:221) refers to as consistency of findings in this study, include dense descriptions of methods like gathering, analysis and interpretation of data which provide information on how repeatable the study is. The code-recode procedure as described by Krefting (1991:221) was used and findings were compared before the final draft was drawn up to enhance dependability. The possible weaknesses of any one method of data collection were compensated by the use of triangulation with other data-gathering methods as described earlier in this chapter.

3.7.4 Confirmability of the findings

In qualitative research, confirmability equates to quantitative research's objectivity. By documenting each claim or interpretation from various sources, I ensured that the data objectively support my analysis and interpretation of the findings (Krefting, 1991:221). Through reflexive analysis, I have also been aware of my influence on the data and have attempted to negate this effect.

3.8 ETHICAL ASPECTS OF THE RESEARCH

Ethics generally are considered to deal with beliefs about what is right or wrong, proper or improper, good or bad about research (McMillan & Schumacher, 2001:196). Naturally, there is some degree of disagreement about how to define what is ethically correct in research (McMillan & Schumacher, 2001:196).

Ethical measures were adhered to during the research even though this study may not be seen as a sensitive issue by all researchers. These ethical measures include ensuring quality of the research, informed consent of respondents, confidentiality, anonymity, and providing feedback on the findings to the respondents.

3.9 SUMMARY

In this chapter the context of the research was first described, followed by a detailed description of the research design. The case study was then described as the strategy of the research followed by the methods of data collection used in the study. Data analysis was highlighted, focusing on qualitative data analysis procedures, and the reasons for doing a literature review in chapter two were explained. Lastly, the trustworthiness of the research was then examined followed by the ethical aspects relating to research of this nature.

CHAPTER 4

RESEARCH FINDINGS

4.1 INTRODUCTION

This chapter reports the findings of the case study, the aim of which is to assess the extent to which the use of computers at a selected school in the Rustenburg district is integrated into education. In this chapter I am going to describe the interviewees' experiences and responses to the utilisation of computers in education. Emphasis is placed on the possible limitations of the use of computers in an educational setting, represented by a selected school. Data collected are analysed by open coding, in order to obtain categories. Data are reduced and labelled as units whose attributes dictated their grouping into categories.

In the first place, I found out whether learners knew what they are learning when using computers and whether they know how to find what they need to access. Secondly I found out whether learners are motivated by the use of computers in education. Finally I found out whether learners communicate more effectively when using computers in the learning situation compared with the traditional classroom situation.

4.2 CONTEXTUALISATION OF THE USE OF COMPUTERS IN A SELECTED SCHOOL IN THE RUSTENBURG DISTRICT

A selected school in the Rustenburg district is a non-racial, state-aided high (secondary) school. A handful of learners at this school come from previously disadvantaged communities. Some still live in shacks that have no access to electricity and proper sanitation. Their parents are either domestic workers, or are unemployed. Some travel a distance of some 2 kilometres to school on foot. The majority of learners come from affluent families, whose homes have most technological appliances including TV sets, VCRs and computers. Their parents are mainly academics or well-to-do business people.

The computers in each laboratory at the selected school are part of a local

network, which allows learners to share information with one another within the laboratories environment. A computer laboratory (or technology laboratory) is a designated classroom fitted with computers and other technology such as printers and projection facilities, earmarked for the use of groups of learners. Teachers schedule time in computer laboratories for an entire class period and do their administrative tasks during this time. The learners suffer, as they are unable to use the computers occupied by the teachers. This worsens the 3:1 learner to computer ratio even further.

The library, the principal's office, the school secretary's office, and the deputy principals' offices are not networked to these two computer laboratories. The two computer laboratories contain forty personal computers between them. There is no access to the Internet in the school, even though it is part of the syllabus for grades 10 to 12. In a sense, access to the Internet provides a window on the world, and lack of access means that teachers and learners at this school are denied an entrée to the extensive and up-to-date school-related information available on the WWW. Its own website would also provide a cost-effective way of communicating with parents.

From my research, it appears that there is no effective technology plan for integrating computers into the curriculum at a selected school. It appears that the school's plan was not based on a shared vision of educators, parents, community members, and business leaders, with sound technological input, as is the case in other schools with which I am familiar. The reason for this assumption is seven of the forty-three PCs in the two computer laboratories are damaged and the school declares that funds for repairs will only be allotted in the following year's budget. A carefully designed technology plan is part of the overall plan for school-improvement. A selected school's technological plan is not integral to the overall improvement of the use of computers in teaching and learning, and it is therefore likely to be short-lived.

The findings reported in this chapter are that computers and software in a selected school in the Rustenburg district are being used, but in many cases as 'add-on' activities, without true integration into the learning repertoire. The reasons for the seemingly slow integration of computers, as educational

resources in the classroom are manifold. Some of the possible reasons emanating from the study are given below.

4.2.1 Age profile of the teacher

The question arises as to how the age profile of the teaching force has a bearing on the slow integration of computers into the educational setting. The average age of teachers in this selected school is close to 40. This means that the teacher training for at least half of the educators was some 10-20 years ago. In addition, there have been limited opportunities for young, new graduates with up-to-date technological skills to gain permanent employment in schools. There were no microcomputers available at the time that most educators qualified, nor had learner-centred theories of learning been widely accepted.

4.2.2 Perceived difficulties of using computers

While advances in technology have made computing much more accessible and user friendly, there is still a significant hill to climb before a person can use one confidently. It needs to be recognised that despite the 'hype' circulated by manufacturers and enthusiasts, computers are sophisticated machines, which require effort from the novice user in order to become a confident user. The teachers at the selected school, in general, perceive the use of computers as difficult.

4.2.3 Inadequate resourcing

Schools generally have never been flooded with money for the purchase of any teaching resource, let alone computers and there has always been legitimate competition for funds from all the curriculum areas. Resourcing of up-to-date, relevant computing facilities is a serious problem at this school, resulting in the ratio of one computer to three learners.

4.3 CHECKLIST OF THE IMPLEMENTATION OF COMPUTERS AT A SELECTED SCHOOL

In chapter two (paragraph 2.6), the possible uses of the computer in education were investigated. This investigation yielded a checklist, which represents all the dimensions involved in investigating computers in an educational setting. By means of observation, questionnaires and interviews, it was determined that a selected school uses computers as represented in the checklist below:

Mark the observation that comes closest to the integration of computers in education with a cross	YES	NO
1 The use of Computers in education (Computer applications)		
- Drill and practice		✓
- Simulations		✓
- Tutorials		✓
- Integrated Learning Systems (ILS)		✓
- Word Processor	✓	
- Spreadsheet	✓	
- Graphics	✓	
- Database Management		✓
- Communications		✓
2. Teaching computer skills		
- Computer literacy	✓	
- Computer awareness	✓	
3. Pedagogical aspects		
(i) Motivation		
- Intrinsic	✓	
- Extrinsic	✓	
(ii) Teaching-Learning strategies		
- Planning	✓	
- Skilled teachers		✓
- Evaluate		✓

(iii) Interaction		
- Learners interact with learning material	✓	
- Learners interacting with other learners	✓	
- Learners interacting with the facilitator	✓	
- Interaction allows for remediation of incorrect responses	✓	
4. Networks		
- Local area network (LAN)	✓	
- Wide area network (WAN)		✓
5. Management, includes		
- Student performance	✓	
- Record-keeping	✓	
- School's budget	✓	
- Student information	✓	

Table 4.1: Checklist of implementation of computers at selected school

4.4 LEARNERS' EXPERIENCES

By means of observation, questionnaire and interviews, the learners' experiences of computer integration was recorded and analysed as follows:

4.4.1 Information arising from interviews

The following information was learned during interviews with the learners.

4.4.1.1 Access to resources

The need for learners to have access to basic necessities, including computers with the essential software, and to have the basic skills and knowledge to use them in all subjects was highlighted. Statements like: ***"our biggest problem is access to the laboratory where computers are kept under lock and key, one cannot complete homework, and Mr X is quick to give out demerits for homework not done." "I wish they could move them to the classes. I don't have a computer at home, and here at school we have quite a few computers and we sit in three's in one computer."*** Teachers should know that learner success is the top priority for planning,

teaching and student assessment.

4.4.1.2 Learners found computers beneficial

Against this background, learners indicated that they know what they are learning when they use computers. One learner said: ***"...At first I didn't know what the computer can do, I thought it was one difficult thing to use, but since I came to this school, I know exactly what I'm learning, I can use different programmes in the computer, I can type for instance using a word processor, I can type a good CV for you, I can also create a slide, add colour to its background and add text."***

Another commented ***"...I wish we could do all our subjects with the computer, do you think it is possible?"*** This question was directed to me. According to Mouton and Marais (1990:162) the qualitative researcher is a subjective person who should not be involved with events or phenomena; therefore I was not influenced to respond to the learner's question. Learners also mentioned some of the software programs that they know to confirm that they are learning like they said: ***"We use Microsoft PowerPoint, Microsoft Word and Microsoft Excel to name a few."***

In order to determine whether learners know what they are learning, progress needs to be indicated, with view of the above statement, one learner mentioned that: ***"... I can draw, paint and play games in the computer."***

"I can use the spreadsheet to perform mathematical operations, enter and modify formulae (they all laughed), ***I like typing letters as it is neat, I can use bold, type and underline the letters and add colour of my choice and save them, later if I wish I will print them it is so nice."***

4.4.1.3 Learners' frustrations

All instructions are written on the whiteboard. Learners are guided through the instructions with help from their teacher and peers. The inability of some learners to function optimally in the computer-based activity can also be ascribed to technological problems that add to the frustrations of learners:

"The ratio of the learners to a computer is 1:3 [sic] which means effective learning does not take place." "The only advantage to this is that we can help one another when one gets stuck with the computer." "One disadvantage is that only the strong survive, it is a matter of who came first to occupy the computer." "Come exam times it is a serious problem, we give one another a chance to write first, when the second group come to write the same exam, they already know the answers from the previous group."

One learner responded: ***"These computers are not serviced by the school and we fork out lots and lots of money to use them, only Mr X cares enough to take it upon his shoulders to service them as the guy has passion for computers."*** Most of the learners said: ***"Computers are very slow to boot, they are old and no one cares to upgrade them."*** They also confirmed that once one had computer skills one is able to get employment.

One learner commented: ***"We so wish to surf the net and communicate with other learners globally, but we can't, electricity is one major problem, the school's electricity is forever cut due to insufficient funds," "The teacher claims that Internet is expensive the school will not afford it." "We would like to send e-mails to our friends overseas and do some projects in the Internet but it is impossible."***

"Funny, in the exams we are asked questions like, what is an e-mail, something we only heard about, which we never saw nor practiced."

4.4.1.4 Learner Assessment

In order to determine whether learners know what they are doing, they need to be assessed. Assessment is an integral part of learning, One learner commented: ***"We are assessed in the form of exercises, tests assignments and projects, feedback is given to us by the teacher after a week or two, sometimes two days later." "We also get a chance to assess our own projects even though computers are infested [sic] with a virus." " One would be lucky if a project which is saved in the stiffs [sic] is still there when all are assessed."***

4.4.2 Information arising from observations

Observation is one of the data collection techniques I used. This kind of observation could not be described as participant observation in the true sense of the word, as I did not participate in the activities in the same way as learners did. As an observer, I jotted field notes, which are a description of the events and activities that transpired. Not all events and activities were translated into field notes, as I was only interested in those activities that related to my research question. Observation was done using an observation schedule.

Learner experiences	Achieved	Not achieved
Computers improve both teaching and learning	✓	
Use of different programmes	✓	
Learners interact with materials		✓
Computers accelerate learner development	✓	
Collaboration plays an integral part	✓	
Computers motivate learners	✓	
Learners know what they are learning	✓	
Computer is a tool for lifelong learning	✓	

Table 4.3: Observation schedule: Learner experiences

4.4.3 Information arising from questionnaires

The questionnaire which participants were asked to complete may be found in appendix D. Informants were asked questions aimed at determining their experiences in using computers in education. The questionnaire yielded the following information concerning learners:

- There was an increased level of interest in and involvement with computers, which may carry beyond schooling.
- Learners showed an improved ability to synthesise or see connection among diverse ideas and information.
- Familiarity with the computer improved attitudes and knowledge toward

their use.

- Learners perceive computerised learning as having an improved overall quality: the learners assess the experience as being *better* than the traditional classroom in some way, involving more holistic learning.

- Those learners who experienced *group learning* in the use of computer in learning are most likely to judge the outcomes of computer use in learning to be superior to the outcomes of traditional teaching. High ability learners will report more positive outcomes than low ability learners.

4.5 EDUCATOR'S EXPERIENCE

By means of observation, questionnaire and interviews, it was obvious that this selected school uses computers as represented by the educator's experience.

4.5.1 Ways of integrating computers in a selected school

To increase the chances of a successful integration of computers into a school, it follows that careful planning of the development of any educational computing resource is an essential prerequisite. Educators need to think and prepare interesting and appropriate learning activities before they face the class.

The interviewee was asked exactly how he uses computers in education in their school. In response he said, ***"Our focus in the use of computer is by and large computer literacy, we develop our own materials for functional computer, we do a lot of stuff from a lot of materials and available manuals and it covers Windows up to Internet."*** The interviewee was asked if they have Internet at school and his response was: ***"Although it is part of the syllabus we are not connected due to funds, most of the time we just tell them instead of show and tell. With computer studies we follow the syllabus prescribed by the department of education."***

4.5.2 Teaching-learning material

Teaching material is one of the major factors in the use of computers in education; in response to this statement the interviewee reiterated, ***"We have textbooks and a curriculum method guideline so we thresh it down into individual lessons, we take the theoretical part and integrate it with the practical component and we expose the learners to such, so we explain and they do it and we check if it is done properly and we evaluate it through monthly tests and exercises."***

4.5.3 Teaching strategies employed

In response to the question, 'Which teaching strategies do you apply when teaching about and when teaching with the computer?' The interviewee responded: ***"Well as for teaching about the computer it is hands-on, learners carry out their own work it is more learner centred,"*** he added that the school comprises the 'haves' and the 'have-nots', ***"they come from totally different backgrounds. I have divided them in groups those who have and those who have not, this has encouraged collaboration among themselves."***

"As for your second question, using the computer in education is at the infancy stage here at our school, I really don't know if it is correct to say when the learners create a budget using spreadsheet is that teaching with the computer? Or if they create a budget for a video shop owner using PASCAL is that teaching with the computer, you tell me, then it will mean it only takes place with learners who do computer studies like this class, as for other subjects they are taught in a face-to-face mode."

4.5.4 Teacher training

Do you use computer applications like drill and practice, simulations, ILS, tutorials when teaching with the computer? ***"My teacher-training programme did not provide future teachers with the kinds of experiences necessary to prepare them to use technology effectively as a tool for teaching. Most of the stuff that we teach these learners is text-***

based, like word processors, spreadsheet and PowerPoint."

4.5.5 Motivation

The interviewer asked the interviewee how he motivates learners to master the desired skills. The teacher said, ***"I train and then evaluate and teach, that is how I go about. For instance, if they have to underline a text, bold it and use Caps lock, they type the text first and follow my instruction verbally to do the abovementioned." "The strategies that I use are deductive and inductive, deductive in the sense that learners can figure out exactly what they are doing when they learn with the computer, and they are motivated to explore even further."***

4.5.6 Learner assessment

"How are learners assessed when using the computer in learning?" The teacher said, ***"Learners are given worksheets to complete, assignments and projects to do in groups then feedback is given within a week or two even within two days when possible after the exercise has been completed, that exercise is checked and learners go through the answers with the teacher to see if they encountered problems or shortcomings. The reason being we have a roll of nine hundred learners, therefore immediate feedback is impossible as we have only two computer labs. Another thing our computers are infested [sic] with a virus called 'Thus', we are negotiating with the principal to buy the Norton Antivirus software".***

In response to how they assess learners, and whether learners have time to assess their own work, the interviewee responded by saying, ***"they save their work in stiffs [sic] and they are given time to go through them, either as a group or as individuals."***

4.5.7 Professional collaboration

The interviewee was lastly asked how he encourages professional collaboration and effectiveness among colleagues and he said:

(Laughter) ***"It is quite difficult as teachers come to school to teach their specialised learning areas, it is difficult but what I did was to take every educator if possible through exposition, through different packages so that every educator could be proficient in the application packages, though we try teachers consider the lack of time to develop computer-based lessons a concern."***

4.6 SHORTCOMINGS IN INTEGRATING COMPUTERS IN A SELECTED SCHOOL

Much can be said about the limitations in integrating computers into teaching and learning, and without any doubt these are significant. While this research did not minimise technological and financial deficiencies, it repeatedly found that teachers' attitudes, beliefs and competencies are the most significant factors. The major incentive for teachers to integrate computers into their classrooms has to do with the belief that it provides a more effective way of enabling children to learn. It was found that lack of confidence and skills with computers, and the need for more in-service training courses are significant factors in the failure of teachers to integrate computers into their classes. It is noted that major drawbacks to the use of computers by teachers are the belief that it will add little value to current practice, the lack of familiarity with computer hardware and software, and the threat to teachers' sense of competency and authority.

An added problem has been that in many cases, the process of introducing computers into a school has been reduced to little more than deciding which brand of computer to purchase. Again, planning of the development of any educational computing resources is essential and appears not to have been the case in a selected school in the Rustenburg district. The strategic plan will reflect the local characteristics of the school and its community and have the support of all stakeholders. Teachers, parents, and students will all feel as though they are contributors to any plan, which is developed. Senior management has to provide the initial momentum for the change to occur and be committed to maintain that momentum throughout. It is apparent in the observation phase that no planning ever took place, this is confirmed by the

low budget and poor maintenance of computers.

4.6.1 Attitudes to change

Integrating computers into educational settings require change. It requires change in the way teachers think about teaching and in their teaching practices. Poole (1995:198) says "the task of making the transition from traditional teaching to teaching with technology is much tougher than it seems. This is because the transition is as much a cultured one as one of mere methodologies. It involves a shift in teaching paradigms, a shift in the way of thinking about teaching." In my findings, I have identified five different types of attitude (also compare Rogers, 1995) among the teachers at the selected school; I will label them as such:

- *Innovators*: These educators are eager for change, and have a desire for the rash, hazardous and risky. Often they are socially ostracised for their attitudes.

- *Early adopters*: Early adopters are not change agents, but they are happy to buy into new ideas. The factors which seem to contribute towards a person being an early adopter include longer education, wider networks, higher levels of literacy, more contact with change agents, greater exposure to mass communication channels, active seeking of information about innovations and greater opinions and greater degrees of opinion leadership.

- *Early majority:* This group follows the early adopters with deliberate willingness. Their profile is similar to that of the early adopters, but they are somewhat less innovative in their position.

- *Middle-of-the-road*: This group is more sceptical and often only takes on the particular innovation as a result of economic pressures, and the influence of peers and society in general..

- *The traditional*: This group holds traditional views and may in fact adopt after the innovation has been superseded.

The problem that arises when change is very frequent, as it is with the use of computers in education, is that only the innovators and the early adopters are able to keep pace with the changes. The middle-of-the-road and the traditional teachers hamper change with their insecurities and their attitudes. Most of the teachers in a selected school in the Rustenburg district fall in the categories early majority, middle-of-the-road and traditional teachers. This poses a threat to the integration of computers in education.

4.6.2 Professional development

As noted above, inappropriate or inadequate professional development is frequently cited as a limitation in the integration of computers into educational settings. During the process of data collection, it emerged that during the teachers' training there were no microcomputers and neither were student-centred theories of learning widely accepted.

These teachers were themselves taught in an era where the teacher was the 'fount of knowledge' and methodologies were primarily in the old didactic tradition in a curriculum that was completely subject compartmentalised; quite the opposite of what is being promoted today. It has been claimed that teachers, as a whole, tend to teach the way they themselves were taught. Many teachers lack confidence to use a computer themselves let alone in a classroom situation and so choose not to do so.

There has been no requirement for teachers to update their teaching skills and qualifications, and for those who have, it has almost always been in their own time and at their own expense. The role of the teacher has not yet changed substantially, a large proportion of teachers while including computers in their teaching are basically still working back in the computer literacy stage.

4.6.3 Access to resources

In this study, it became apparent that learners are taught technology in specialised laboratories as separate courses. Computers are placed together in a room (laboratory) that is well equipped with both hardware and software.

Learners gain access to the laboratory *only* when their class is scheduled for its use. A computing specialist teacher is appointed to take computing lessons; this encourages the classroom teacher to leave computing to the specialist.

Learners have problems of access to computers when they have homework, assignments or projects to do after school, because the laboratory is locked. Most of these learners have no computers at home; therefore finishing their work becomes impossible. When the computing specialist teacher is absent from school, the laboratory is kept under lock and key for the rest of his leave. Because learners are taught technology in specialised laboratories, they cannot learn how those skills could assist in other facets of their lives; they are denied the opportunity to learn that computers are tools, which could be used in numerous ways in all areas of schooling and beyond.

Furthermore, as the computer is becoming increasingly important, learner access to computers in this selected school is inequitable. Only those learners who do computer studies become more computer literate, as the main focus is on these learners. Those learners doing functional computing are compromised, as they are not given an adequate knowledge base for computers. These learners are being prejudiced, as they are ill prepared for today's technologically driven society.

Many students do not have the equipment to access computer-based materials, and especially multimedia material, either at home or at school. The school's computer department, including its head, has a vision that is focused on obtaining hardware and software, with little attention given to changing learning strategies. The amount and quality of collaboration depends on the design of the software.

4.6.4 Cost of resources

Computing hardware is very expensive as is computer maintenance. In the selected school, the cost is distributed to the learners who do computer studies by means of charging them an additional fee. This causes resentment among them.

Developing original, high-quality computer-based learning material is expensive and requires highly skilled designers, if more than drill and practice techniques, or simple memorisation principles, are required. The school buys expensive software from overseas which is foreign to their culture and curriculum.

4.7 SUMMARY

This chapter reported first on the methods of data collection, namely, observation (field notes), focus group interviews, individual interviews and questionnaires. It then described the data analysis, during which qualitative data reduction techniques were used to identify and establish the possible uses of computer in the selected school, learner experiences, educator experiences and the limitations in the integration of computers in educational settings, represented by the selected school.

The findings of this study indicate that professional development of teachers is very important. In addition, an adequate supply of computer hardware and software in schools will mean that classes are equipped with sufficient technology and computers will no longer be confined to laboratories. Learners will then acquire hands-on computing skills. A carefully designed plan will enhance overall school-improvement. This can be an effective tool for improving and ultimately, transforming teaching and learning situation.

Chapter five of this mini-dissertation summarises the study, points out the limitations of the research and makes recommendations for further research on the topic.

CHAPTER 5

SUMMARY, CONCLUSION, LIMITATIONS OF THE RESEARCH AND RECOMMENDATIONS FOR FURTHER RESEARCH

5.1 INTRODUCTION

The aim of this study is to investigate a selected school in Rustenburg and to propose ways of addressing the difficulties regarding the integration of the use of computers in that educational setting, as uncovered by the research. This study examined the extent to which computers are used in a school and the problems it encountered in the integration of computerisation.

5.2 SUMMARY OF THE CHAPTERS

Chapter one surveyed the context of and the rationale behind the study. The research problem, together with the aim of the study and its objectives were set out; and the research methodology was described in overview. At the end of the chapter the organisation of the mini-dissertation was explained. In chapter two, the literature review gave a broad perspective on the contemporary views and theories on the integration of the use of computers in the educational setting, both internationally and locally. It covered the rationale for the use of computers in education, as well as the perceived limitations thereof. It included a survey of how computers are used in education and the pedagogical aspects of their use. The chapter concluded with a checklist for assessing the state of the integration of computerisation in an educational setting.

The research design of the study was explained in chapter three, as well as the methods of research and data collection. This chapter also gave details of the analysis of the qualitative data, pointing out the role of the literature review in the research, and the need to produce a trustworthy study that is ethically sound. Chapter four presented the research findings of the study arising from the data analysis. Having contextualised the study, the chapter sets out the experiences of the learners as captured by the researcher, as well as those of the educator that was interviewed. It then details the perceived shortcomings in the area of integration of computerisation into a selected school.

5.3 FINDINGS

This study was directed towards emphasising the difficulties in integrating computers in the educational milieu, generally, and more specifically into teaching and learning. It referred to the importance of professional development as a key to the integration of computers into learning environments. It is important that the professional development addresses teachers' concerns at a practical level, tackling issues such as control and attitudes: and a few strategies for doing this were then suggested.

In chapter one the research question was formulated as follows: **"What are the deficiencies in integrating computers in a selected school in the Rustenburg district and how might these limitations be addressed?"** The conclusions in this section have been drawn directly from the evidence discussed in chapter four as well as the criteria for the integration of computers in the selected school, derived from the literature review and are represented in the checklist in chapters two and four.

The aim of the study is to investigate a selected school in the Rustenburg district and to propose ways at addressing the deficiencies in the integration of computers into the educational setting. In this regard, the study contextualised the use of computers in a selected school in Rustenburg district (paragraph 4.2) the learners and teachers confirmed the findings of the literature review (paragraphs 4.3 and 4.4). In this study an assortment of learner experiences, backgrounds, competencies and skills, as well as educator experiences became apparent as subjects that play a major role in the use of computers in education.

The use of computers in education can have a positive impact in learning, which takes place in the classroom. It is not the technology itself, but the manner in which it is utilised that makes it a valuable or valueless activity. The teacher remains the most important factor in the learning equation, as it is he who determines what transpires in the classroom.

It follows that it is critical to attend to the professional development of teachers in the effective use of technology. To date, this professional development of teachers regarding the integration of computers into education has been short of

what is required, as it has not dealt sufficiently with equipping teachers with a teaching and learning philosophy on which to base the use of computers in the curriculum.

It is evident that what hinders the integration of computers in a selected school is lack of teacher training; lack of administrative support; limited time for teacher planning; computer placement in remote locations (the laboratory), making it difficult for learners to have access; budget constraints; and a basic resistance to change by many educators. Every educator looks at the integration of computers and its challenges from a different perspective; they consider the lack of time to develop computer-based lessons a concern.

Assessment is an integral part of learning and all learners will succeed at their own time and pace. Learners confirmed that they have the opportunity to assess their own projects and those of their fellow learners; the only problem that was highlighted by the learners was that computers are infested with a virus which can delete everything that is saved on a diskette; when the teacher assesses projects it might be that the virus has destroyed contents of the diskette.

It should be an aim of the management of a selected school to allow learners free access to computers and software appropriate to the task at hand. This does not necessarily translate into each learner having his or her own computer, but does suggest that there ought to be some equipment available for easy access in the classroom, in the library or resource centre, or in an area set aside for learners to work in.

There is a great deal of speculation about the potential of the computer in changing the nature of the teaching and learning. Teaching can change because the computer provides a potentially powerful and flexible alternative mode of delivery. Learning can alter because the focus can increasingly be on access to, and management of, knowledge, rather than on rote acquisition of knowledge.

5.4 RECOMMENDATIONS FOR FURTHER RESEARCH

The recommendations for further research listed below are based upon limitations discovered in both literature and findings regarding the integration of

computers into education.

- Inadequate pre-service teacher training courses and inappropriate in-service workshops ... [do] not prepare teachers to integrate computers in their teaching." This statement is worthy of further investigation.

- A first-rate education system requires the continual upgrading of teachers' skills to maintain the quality of professional services. Teachers are the 'human dimension' in the use of technology in the classroom. A study into the practice of the maintenance of professional services could serve a useful purpose.

- Examining the different approaches to learning which might best accommodate the integration of computers in education could benefit the teaching profession.

- Discovery as to what physical arrangement might be made in the classroom to improve accessibility, security, supervision, and other similar issues might alleviate learner frustration.

- The findings of this study showed that learners have the opportunity to assess their own computer skills. A further enquiry could be conducted on assessment to find out which assessment tool could best serve the assessment need.

- The type of learning methodology that can be best used to reinforce familiar knowledge, to refine a particular skill and concept can be explored.

- Mere exposure to computers does not hold any educational benefits into the use of computers in education, but exposure to specific computer applications could produce specific educational benefits. Investigating this statement further could further the overall value of computing in education.

- Planning of the development of any educational computing resource is an essential prerequisite, the strategic plan should reflect the local characteristics of the school and its community and have support of all stakeholders.

Determining the optimum development plan could aid the educational community as a whole.

5.5 LIMITATIONS OF THE INVESTIGATION

This study investigated the use of computers in education in a selected school in the Rustenburg district. The focus of the investigation was only in one school, and therefore the findings cannot be generalised to learners in other schools. That learners were motivated in their use of computers in education simply because they were doing something different, does not mean they were doing something better.

Regardless of how a selected school uses computers, one major setback is the poor management of computer access and the learners' computer time. The most awful was that because untrained teachers were unable to decide how best to use the computers in the laboratories, they left the responsibility in the hands of the specialist teacher.

5.6 CONCLUSION

In conclusion I would like to point to the words of Hodas (1998:89), "No technology is ever neutral: its values and practices must always either support or subvert those of the organisation into which it is placed." and "...the failures of technology to alter the look-and-feel of schools frequently result from a mismatch between the values of school organisation and those values that are embedded within the contested technology."

In all applications of computer education, there is a need to learn to expose learners (and teachers) to the many facets and variables that comprise information technology. If the aim is to create lifelong learners, then learners should be provided with the basic understanding that "computer" is not a separate course that one does in school; it is a tool that is used in today's society, an instrument that will help learners become informed citizens in ever-changing, information-driven society.

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APPENDIX A

TRANSCRIPT OF AN INDIVIDUAL LEARNER INTERVIEW

Researcher: Good afternoon.

Respondent: Good afternoon Ma'am.

Researcher: How are you?

Respondent: I'm fine thanks, how are you Ma'am?

Researcher: I'm fine thank you.

This interview is all about an assessment on the use of computers in your school, the deficiencies in integrating computers in education and how can they be addressed.

Please you must feel free to answer any question, if you agree or disagree, you must feel free to express your own opinion. '

My first question is: How often do you use computers in your school?

Respondent: Well, we have two periods in a cycle according to the school's timetable to use computers in the laboratory.

Researcher: It is said that computers arouse independent thinking, could you substantiate.

Respondent: It is true the user use his or her own discretion, no one interferes, there are various icons in the standard and formatting tool bars which the user can choose from, it is a trial and error thing, a person thinks and applies his/her thought.

Researcher: Do you get feedback from your facilitator about your progress?

Respondent: Yes, although it is not immediate, sometimes group leaders do it in class, and all learners do corrections.

Researcher: What motivates you to use computers?

Respondent: The fact that computers are private; they cannot tell when you make a mistake, they do not have mood swings, they wait patiently for a person to perform a task at his/her own pace.

Researcher: What problems do you have in connection with your use of computers?

Respondent: Our biggest problem is access to the laboratory where computers are kept under lock and key, one cannot complete homework, and Mr X is quick to give out demerits for homework not done. I wish they could move them to the classes. I don't have a computer at home, and here at school we have quite a few computers and we sit in three's in one computer.

Researcher: When using computers, do you know what you are learning?

Respondent: At first I didn't know what the computer can do, I thought it was one difficult thing to use, but since I came to this school, I know exactly what I'm learning, I can use different programmes in the computer, I can type for instance using a word processor, I can type a good CV for you, I can also create a slide, add colour to its background and add text.

Researcher: Are there enough computers for all the learners to use?

Respondent: The ratio of the learners to a computer is 1:3 [sic], which means effective learning does not take place. The only advantage to this is that we can help one another when one gets stuck with the computer. One disadvantage is that only the strong survive, it is a matter of who came first to occupy the computer. Come exam times

it is a serious problem, we give one another a chance to write first, when the second group come to write the same exam, they already know the answers from the previous group.

Researcher: Do you have any other comments about the computers?

Respondent: These computers are not serviced by the school and we fork out lots and lots of money to use them, only Mr X cares enough to take it upon his shoulders to service them as the guy has passion for computers. The computers are very slow to boot, they are old and no one cares to upgrade them. We so wish to surf the net and communicate with other learners globally, but we can't, electricity is one major problem, the school's electricity is forever cut due to insufficient funds, the teacher claims that Internet is expensive the school will not afford it. I would like to send e-mails to my friends overseas and do some projects in the Internet but it is impossible. Funny, in the exams we are asked questions like, what is an e-mail, something we only heard about, which we never saw nor practiced.

Researcher: How are you assessed in your computer education classes?

Respondent: We are assessed in the form of exercises, tests assignments and projects, feedback is given to us by the teacher after a week or two, sometimes two days later. We also get a chance to assess our own projects even though computers are infested [sic] with a virus. One would be lucky if a project which is saved in the stiffs [sic] is still there when all are assessed.

Researcher: Thank you very much for your time.

Respondent: You are welcome.

APPENDIX B

TRANSCRIPT OF THE FOCUS GROUP INTERVIEW

The focus group consisted of leamers in grade ten, they were chosen randomly irrespective of gender and capability.

Researcher: Good day, leamers.

Respondents: Good day, ma'am.

Researcher: This interview is all about an assessment of the use of computers in your school, to find out as to whether they are integrated in education; if not, so what are the deficiencies in the integration of computers in education and how can they be addressed. You must feel free to answer questions whether you agree or disagree; feel free to express your opinion.

Researcher. How many of you have computers at home?

Respondent A: My parents own two computers, one is in the study room, the other one is at my father's business.

Respondent B: My brother has a computer.

Respondent C: My uncle works at the computer shop as a technician sort of because he fixes them, therefore he only brings a few home for repairs, in that way we own some.

Respondent D: We don't have a computer at home to use.

Respondent E: My parents are in the process of buying us a computer.

Respondent F: We don't have a computer at home.

Researcher: When using computers, do you know what you are doing?

Respondent A: I do because I use it very often at home, I play games and watch movies, play music and record some CDs.

Respondent B: Yes, I like playing cards on our computer and type letters and business cards you know, that kind of stuff.

Respondent C: Yes, very much so, I learn most of the stuff from my brother, the parts of the computer, I've seen a motherboard at home when my brother was fixing a computer, I play games and load many softwares for movies.

Respondent D: Yes, I know, because at school we have computers and we are allowed during the period to use them, I can draw a picture and paint in the computer, of course yes.

Respondent E: Yes, because I can type a neat CV, something I could not do before I came to our school.

Respondent F: Well sometimes I do, sometimes no.

Researcher: It is said that computers are friendly. Could you explain this statement?

Respondent A: I believe it is true, they never shout at us like our teacher does.

Respondent B: They are friendly 'cause they'll never make a joke about you for the class to laugh at you.

Respondent C: Shoo! These machines are clever, when you make a mistake, they'll not tell a soul.

Respondent D: Ma'am, when you mind is far away in class, the machines wait for you patiently until you come back

Respondent E: They help you when you make mistake, when the answer is correct, Buddy a froglike animal will jump up the screen to say hey this is correct.

Respondent F: Yes, it is true, they are friendly, when a person spells a letter incorrectly, they are quick to underline that letter with a red

colour, to say something is wrong. You know, red means danger. (They all laugh.)

Respondent A: Yes, the computer does have a place in our school, even though it is only placed in the library and the computer lab, we don't have them in our classrooms.

Respondent B: If they were to be put in the classrooms, certain things would have to change, more security, furniture, all that means money my parents would not afford to pay too much school fees to accommodate all that, I think their rightful place is the lab.

Respondent C: Yes, they are in their rightful place the lab, the managers office and the library as well as the school's secretary's office.

Respondent D: In our school the computer belongs to the teacher who determines its use.

Respondent E: I can say it has a place because we have to big computer labs where computers are based for access; two in the library for library use only when we want to search for various careers and institutions and relevant subjects it has that information.

Respondent F: Ja, they are friendly, what I like the most about them is that they have a built in dictionary, the thesaurus; a person doesn't need to consult Oxford.

Researcher: This is my last question. Which software applications do you mostly use and what do you use them for?

Respondent A: We use word process in projects let me say in every possible content domain.

Respondent B: We use spreadsheet to do calculations, create budgets and stuff.

Respondent C: We use graphics in every application to improve the appearance of assignments and projects. I enjoy colouring using the paint program in windows.

Respondent D: We use Power Point to create slides, although we type words like in word processing, select, edit and format text, cut and paste, I like the slide show very much.

Respondent E: Much is said about databases and templates, that stuff we would probably do next term, word processing is our daily bread.

Respondent F: I think even my teacher like word processing, every day in the lab she likes to instruct us to go to word, type letters, CV and give marks for creative work.

Researcher: Thank you learners you were very helpful, good-bye

Respondents: Good-bye Ma'am, see you next time.

APPENDIX C

TEACHER'S QUESTIONNAIRE

Thank you for agreeing to answer a few questions about your experience and technical competence in the use of computers in this school. It is the aim of this study to determine your experience in the use of computers at this school. Your input is highly valued and essential for the completion of this study. The questionnaire consists of two sections. Section A consists of the teacher's personal information and section B consists of 8 questions which are based on the use of computers in this selected school in the Rustenburg district.

Please answer the following questions as honestly as possible:

THE QUESTIONNAIRE

Section A

1. How long have you been teaching?

   Eleven years

2. What is your field of speciality?

   Afrikaans and Geography

3. Which subjects are you teaching?

   Geography and computer literacy

4. Which grades are you teaching?

   Grades 10s and grades 12s

Section B

5. Did you have any exposure to computers before, if so explain how you acquired it?

   Before I came to the selected school, I was already familiar with computers. I obtained a diploma certificate course at Damelin School of computers and an A+ certificate. When I started using computers at the selected school I had a qualification in the use of computers.

2. Do you have access to a computer at home?

   Not really, I only rely on the school's computer laboratory.

3. What is your understanding about the integration of computers in education?

   I think it is a unique, effective, and powerful opportunity for many different types of teaching and learning, it provides interactivity, learner control, and student engagement. It combines all parts of technology, such as hardware and software with a related area of the curriculum for instance Biology to enhance learning.

4. How do you plan your lessons?

   We have the textbooks and a curriculum method guideline so we thresh it down into individual lessons; we take the theoretical part and integrate it with the practical component.

5. Which strategies do you use when teaching computer skills?

   It is hands-on instruction for learners, learners carry on their own work, it is more learner centred.

6. How do you encourage collaboration amongst learners?

   Learners work in groups; in that manner they collaborate.

7. What is your view about computers in education?

   I believe when used appropriately computers have the potential to enhance learners achievement, help many individuals accomplish many job-related tasks more efficiently and effectively

8. In your view, which programme attracts learners to the computer laboratory?

Learners are mostly attracted to Word Processing and Power Point because they type letters, write CVs, add colour you know all that stuff, they enjoy the slide show too, they like it when the slide has effects and animation.

Thanks for your time! This is a confidential form.

APPENDIX D

LEARNERS' QUESTIONNAIRE

Thank you for agreeing to answer a few questions about your experience in using computers in education. It is the aim of this study to determine the experience of learners in a selected school in the Rustenburg district with regard to the integration of computers in education. Your input is highly valued and essential for the completion of this study.

Please answer the following questions as honestly as possible by writing the correct answer in the boxes provided:

1. What motivates you to use the computer?

Respondent A	*I am fascinated with the intelligence of the machine.*
Respondent B	*I can communicate with people around the world.*
Respondent C	*I like playing games and music.*
Respondent D	*Typing in Microsoft Word comes up neatly, you can use any font size and font and colour it anyhow with your favourite colours.*
Respondent E	*I like changing the computers screen saver, there is variety but my favourite is the ocean screen saver, it has the feel of the ocean and blue skies*
Respondent F	*Microsoft Power Point is my favourite one, especially when the text has effects and animation, check when it is in Spiral mode, it zig-zags.*

2. Which skill(s) have you acquired using the computer?

Respondent A	*Word processing*
Respondent B	*Keyboarding skills*
Respondent C	*Problem solving*
Respondent D	*I can cut, paste, edit and copy text*
Respondent E	*I can hold the mouse pointer firmly to the mouse pad and point at the text, select it and right-click on it*
Respondent F	*I can insert a word, bold and underline it*

3. How is assessment done when using the computer?

Respondent A	*We do projects in the computer as part of our continuous assessment.*
Respondent B	*We write assignments.*
Respondent C	*Class work is given to us after the completion of every lesson to complete in the computer.*
Respondent D	*Class tests are written in every two weeks, they vary from different programmes.*
Respondent E	*The teacher gives us programmes which are different from one group to the other, after completion we swap projects in groups and mark them, then our teacher goes through them again and give us marks.*
Respondent F	*We write cycle tests.*

4. Is the computerised learning better that the traditional classroom and why?

Respondent A	*Learning with the computer is fascinating because you are in control, you follow the procedure and the instructions that is all and you are there.*
Respondent B	*It is only yourself and the computer you think hard to solve a problem and the computer waits for you.*
Respondent C	*A computer has a feel of independence, each time I use the computer I see myself someday become a computer expert and do business with my computer.*
Respondent D	*It is not threatening, once you get used to it, you will never stay without it.*
Respondent E	*It tempts you to want to know more and go on and on*
Respondent F	*Well may be, may be not when you don't know how to type fast you cannot finish your task on time, whereas in the traditional classroom you can write as fast as you can*

Thank you for your time! This is confidential form.

APPENDIX E

TRANSCRIPT OF THE INDIVIDUAL INTERVIEW WITH THE EDUCATOR

Researcher: Good afternoon.

Respondent: Good afternoon, Ma'am.

Researcher: How do you use computers in education in your school?

Respondent: Our focus in the use of computer is by and large computer literacy, we develop our own materials for functional computer, we do a lot of stuff from a lot of materials and available manuals and it covers from windows up to Internet.

Researcher: Do you have access to the Internet at your school?

Respondent: Although it is part of the syllabus we are not connected due to funds, most of the time we just tell them instead of show and tell. With computer studies we follow the syllabus prescribed by the department of education.

Researcher: Teaching material is one of the major factors in the use of computers in education. What material do you have available?

Respondent: We have textbooks and a curriculum method guideline so we thresh it down into individual lessons, we take the theoretical part and integrate it with the practical component and we expose the learners to such, so we explain and they do it and we check if it is done properly and we evaluate it through monthly tests and exercises.

Researcher: Which teaching strategies do you apply when teaching about and when teaching with the computer?

Respondent: Well as for teaching about the computer it is hands-on, learners carry out their own work it is more learner centred. The learners

come from totally different backgrounds. I have divided them in groups those who have and those who have not, this has encouraged collaboration among themselves.

Using the computer in education is at the infancy stage here at our school, I really don't know if it is correct to say when the learners create a budget using spreadsheet is that teaching with the computer? Or if they create a budget for a video shop owner using PASTEL is that teaching with the computer, you tell me, then it will mean it only takes place with learners who do computer studies like this class, as for other subjects they are taught in a face-to-face mode.

Researcher: Do you use computer applications like drill and practice, simulations, ILS, tutorials when teaching with the computer?

Respondent: My teacher-training programme did not provide future teachers with the kinds of experiences necessary to prepare them to use technology effectively as a tool for teaching. Most of the stuff that we teach these learners is text-based, like word processors, spreadsheet and PowerPoint.

Researcher: How do you motivate the learners to master the desired skills.

Respondent: I train and then evaluate and teach, that is how I go about. For instance, if they have to underline a text, bold it and use Caps lock, they type the text first and follow my instruction verbally to do the abovementioned. The strategies that I use are deductive and inductive, deductive in the sense that learners can figure out exactly what they are doing when they learn with the computer, and they are motivated to explore even further.

Researcher: "How are learners assessed when using the computer in learning?

Respondent: Learners are given worksheets to complete, assignments and projects to do in groups then feedback is given within a week or two even within two days when possible after the exercise has been completed, that exercise is checked and learners go through the answers with the teacher to see if they encountered problems or shortcomings. The reason being we have a roll of nine hundred learners, therefore immediate feedback is impossible as we have only two computer labs. Another thing our computers are infested [sic] with a virus called 'Thus', we are negotiating with the principal to buy the Norton Antivirus software.

Researcher: Do learners have time to assess themselves?

Respondent: They save their work in stiffs [sic] and they are given time to go through them, either as a group or as individuals.

Researcher: How do you encourage collaboration among your colleagues?

Respondent: (Laughter) It is quite difficult as teachers come to school to teach their specialised learning areas, it is difficult but what I did was to take every educator if possible through exposition, through different packages so that every educator could be proficient in the application packages, though we try teachers consider the lack of time to develop computer-based lessons a concern.

Researcher: Thank you very much for your time.