EVALUATION OF SOLAR-POWERED COMPUTER USE BY EDUCATORS AT MYEKA HIGH SCHOOL, RURAL KWAZULU-NATAL

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ABSTRACT

The potential of solar systems to generate electricity to power computers in rural schools has been realised in areas where grid electricity is inaccessible. While donors may willingly donate computers to rural schools, the extent of their use is questionable. The purpose of this study was to investigate the extent to which Myeka High School educators used solar-powered computers and to determine factors affecting computer use. Myeka High School is located in the rural KwaZulu-Natal midlands, in the Ndwedwe district. It is characterised by a lack of grid electricity and basic infrastructure. Through private funding this school was provided with 20 solar-powered computers. A combination of survey questionnaires, observations, informal interviews and focus group discussions was used to collect data from 25 school staff, after computer training and Internet Explorer program access at the school. Data collected included educators' computer skills level, type of software used, time spent using computers and factors affecting computer use at the school.

Survey results showed that the majority of educators were computer literate and used word processing more frequently than other software programs, but spent a relatively short duration of time using computers. The computers' capacity to enhance educators' tasks was the main motivation for them to use computers. However, low human capacity, high computer maintenance costs and poor physical infrastructure constrained educators' computer use. Recommendations are that interventions aimed at promoting computer use by rural educators should first develop human capacity and improve the infrastructure for using and maintaining computers. Implications for further research are to get learners' perspectives on computer use and to conduct a comparative study between solar-powered computer and grid electricity-powered computers in schools, to further understand factors limiting computer use.

Lord you have examined me and you know me,

You know everything I do, from far away

You understand all my thoughts

You see me whether I am working or resting

You know all my actions

Even before I speak

You already know what I will say

You are all around me on every side

You protect me with your power

Your knowledge of me is too deep,

It is beyond my understanding

(PSALMS 139:1-6)

Good news Bible, Today's English version, Bible Society of South Africa (1993), 3rd ed.

DECLARATION

I hereby declare that this research is of my own investigation, and has not been submitted for any other degree. Where use was made of the work of others, this has been duly acknowledged in the text.

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        Nurse Bongi Dube   **Date**

As the study supervisor, I agree/disagree to submission of this thesis for examination.

Supervisor: _____   _24 March 2003_
        Prof JM Green   **Date**

As the study co-supervisor, I agree/disagree to submission of this thesis for examination.

Co-Supervisor: _____   _____
        Dr SL Hendriks   **Date**

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CHAPTER 1
THE PROBLEM AND ITS SETTING

1.1. Introduction to the research problem

Myeka High School is a public rural school founded in 1980. The school is located in the KwaZulu-Natal midlands rural village of Maphephetheni in the Ndwedwe district, 80 kilometres west of Durban city. The village of Maphephetheni is under the leadership of Chief Frank Gwala. The terrain is very mountainous and homesteads are extremely dispersed, thereby rendering grid electrification uneconomical. This school is characterised by its remoteness, by unreliable transport, lack of grid electricity and telephones and by poorly maintained dirt roads which are impassable when wet.

In 1995, a partnership between the South African government and an American-based energy organisation, the Solar Energy Light Fund (SELF), initiated a programme to introduce solar home lighting systems to rural households in the village of Maphephetheni. Through this programme, the Headmaster of Myeka High School, Melusi Zwane, learned about solar energy and requested assistance in establishing a solar-powered computer centre in his school. His main objective was to provide students with vocational education.

In 1995, the national electricity supplier, Electricity Supply Commission (ESKOM) and subsequently Shell Renewables, installed two pole-mounted solar/photovoltaic (PV) arrays. The installation of the second solar system was funded by SELF and managed by Solar Engineering Service (SES), a representative of SELF in South Africa. SELF persuaded local and national private business to donate technology facilities and equipment to the school (Lipschultz, 2001). The installation of the solar system led to the acquisition of 20 computers, a television, a video recorder, an overhead projector, a Compact Disk copier, four printers, a photocopier, satellite Internet connections and access to digital media by the school. The Eskom/Shell solar arrays deliver power to the Home Economics classroom (with one computer), Physical Science laboratory (with one computer), resource centre (with Internet Explorer), Headmaster's office, HOD's office and lights to all rooms at the school.

However, the Eskom/Shell system could not supply power to the school's 20 computers. In 1998, the Mangosuthu Technikon installed a solar/LPGas Hybrid system at Myeka High School, in order to supply power to the school's computer centre, as the existing system could not supply the power. The solar/LPGas Hybrid system provides power to AC plug points in the computer centre that uses an average of 9900kWh per day, or 75% of the total energy output. The 20 computers can run on solar energy alone for three to seven hours (Kempenaar and Wiersma, 2000). Later in 1998, the former South African Minister of Minerals and Energy opened the first rural solar-powered computer centre in South Africa, at Myeka High School (Cawood, 2000).

Studies have shown that the conditions necessary for development of computer use in South African schools centre on access to basic resources such as electricity, computer hardware and software, the presence of educators skilled in computer use, and maintenance backup (Howell and Lundall, 2000). Educators also need to understand the role of computer use in the educating and learning process (Chetty, 2000). In developing countries, limitations resulting from the lack of basic infrastructure such as electricity and telephones are slowly being overcome. The role of solar systems to generate electricity to power computers in rural schools has begun to be realised (O' Kennedy, 1995a).

The solar (PV) system, the technological equipment and computer facilities at Myeka High School have been in position for almost three years with no evaluation of their use. The installation of the solar system in such a deep rural school, and provision of computers drew attention of three academic institutions in KwaZulu-Natal to collaboratively investigate the functioning of these facilities from different approaches. One study focussed on the potential role of rural schools in Maphephetheni as community resource centres. A second study looked at the learners' perspectives and outcomes from the technology. A third study focussed on the technical aspects of the system by investigating the efficiency of the solar/LPGas system in powering the computer centre. Given the installation of the solar system, the provision of computers with relevant software and training of educators, this section of the wider study investigates the extent to which educators use solar-powered computers and determines the factors motivating and constraining the use of computers by the educators in Myeka High School.

1.2. Importance of this study

A study of the provision and maintenance of computer hardware in South African schools found that in many schools, computers were donated by private and public business enterprises (Cedras and Selikow, 1998). This was manifested in 1999, when the Telkom Foundation provided 1000 computers and Internet-access points through its Telkom1000 Schools Project, throughout South Africa (Brandjes, 1999:2 cited by Garson, 1999:2). The aim of the Telkom 1000 Schools Project was to increase access to computers and the Internet, especially in historically disadvantaged schools in South Africa (Brandjes, 1999:2 cited by Garson, 1999:2). Telkom also appointed the NGO SchoolNet SA (which co-ordinates the implementation of information and communication technologies, as well as training and human resources development in South Africa on a national level) to train over 2000 educators in South Africa, as part of its commitment to ensure that educators could effectively use the computers for educational purposes. Garson (1999) points out the South African National Department of Education is more concerned with providing school buildings, educators and textbooks than providing computers. Only very recently has the Department of Education begun to turn its attention to providing Internet to schools which already have computers. This indicates that the provision of computers to South African schools and computer training to educators has largely been left to private and public business enterprises.

The SchoolNet executive director, Dennis Brandjes, says "You can easily put computers into schools but the question is how you use them" (Brandjes, 1999:2 cited by Garson, 1999:2). Installing computers in schools is very attractive because they give a feeling of progress and enable sophisticated demonstration programmes (Osin, 1998). The aim of introducing computers to schools is to use them as tools for teaching and learning subject matter and administrative and management tools (Miller, 1997). Once computer equipment is provided, the next step should be to discover how the educators are using the computers or whether they are prepared to integrate the computer activities with their current tasks (Osin, 1998). Therefore research is needed into the actual computer use in schools to achieve this aim, the barriers preventing increased use and how these barriers might be broken down (Cawthera, 2001). Chetty (2000) argues that donating computers to schools without providing the necessary training support is a waste of time and money.

Grenfell (1999) asserts that a common assumption entertained by many educators and professional development providers is that by developing skills and knowledge concerning computer hardware and software educators will inevitably use computers in the classrooms for teaching activities. However, while educators need to build familiarity with software, it is also important that they develop an understanding of how to use computers in a range of teaching and learning applications through on-going training support from colleagues and regular on-going professional development programmes. If educators do not build familiarity with computers, the chances are they will not use them (Cedras and Selikow, 1998).

The obstacles to greater use of computers in schools are lack of necessary computer skills among educators and resistance to change (Selinger, 2000). Studies indicate that computers can consume school resources without making a valuable contribution to the teaching and learning process (Cedras and Selikow, 1998). The role of the educator is crucial in the full development and use of computers in schools (Trotter, 1999 cited by North Central Educational Laboratory (NCREL), 2000). Given the lack of supportive environment for the proper operation of technical infrastructure in rural Myeka High School and the general lack of National Department of Education official support for computers in schools, is it worthwhile installing computers in rural high schools?

1.3. Statement of the problem

This study investigates the extent to which educators at Myeka High School use solar-powered computers and determines factors motivating and discouraging educators' use of computers.

1.4. Hypothesis and the sub-problems

Hypothesis: The use of computers by Myeka High School educators was accelerated by Internet access when supported by relevant training, the physical infrastructure and school management capacity.

Sub-problem one: To investigate the use of computers in terms of educators' computer skill training level, software types and time spent on computer use in Myeka High School.

Sub-problem two: Does Internet Explorer access and training increase Myeka High School educators' extent of computer use for their tasks?

Sub-problem three: What are the key factors motivating and discouraging the use of computers by educators at Myeka High School?

1.5. Conceptual parameters

The use of solar-powered computers is determined by educators' computer use skills level, the availability of software types relevant to educators' tasks and the availability of time. The use of computers is also determined by improvement in educators' skills and educators' benefits for their tasks. It is anticipated that Internet Explorer access might increase educators' extent of computer use and time for subject information searching and communication, as this programme requires time to sift through the information. However, use of the Internet is determined by educators' skills level and the time available to use it. Computer use in schools may also be affected by the way in which computers were introduced to educators, running/maintenance costs affordability and educators' personal obstacles to greater use of school computers. The factors determining use, the benefits of computers for educators' tasks and Internet use all influence educators' tasks. The relationships among the sub-problems are illustrated in Figure 1.1. In order to investigate the research problems, data will be obtained through survey questionnaires, focus group discussions, observations of computer use and informal interviews with the Headmaster and the educators found using the school computers.

1.6. Study limits

The study was limited to investigating the extent to which educators use solar-powered computers in Myeka High School. No comparative study was possible regarding the use of computers in other schools, as this was the only rural school with solar-powered

computers in the KwaZulu-Natal province at the time of the survey. This study was also limited to investigating Myeka High School Headmaster's view on the effects of computer maintenance costs on computer use by the educators.

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┌─────────────────────────────────┐
│ Use of solar powered-computers at │
│ Myeka High School in supporting  │
│ educators' tasks                 │
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- Educators' computer skills level
- Type of software available for educators' tasks
- Educators' time availability

Factors motivating computer use
- Achievements and improvements through computer use
- Benefits from computer use in the school

Internet Explorer access increases educators' computer use extent

Factors discouraging computer use
- Educators' human capacity
- School management
- School's physical infrastructure

Improvement in educators' tasks

Figure1.1: Conceptual framework.

1.7. Definitions of terms

Educators' tasks –   the term has been used in the present study to refer to educators' activities which support the teaching learning process and those required in administration and school management. The activities include information searches, lesson preparation/note summaries,

class activities, class assessment (tests, examinations), recording learners' progress (marks, class averages), preparing learners' reports (results), class administration (class register, duty lists and timetable) and the school budget.

Solar/Photovoltaic array -   a device that converts light energy (from the sun) into electrical energy.

Stand-alone solar electric system -   a solar electric system that receives all of its energy from solar electric charge and which is not connected to the gas/petrol/grid source of power.

Chalkboard-driven education-   Educators prepare classroom lessons from prescribed textbooks and deliver them through talking and writing on a chalkboard.

Technology-driven education-   Educators use technological facilities such as computers to download curriculum content and also deliver lessons in classrooms through technology.

1.8. Abbreviations

AC- Alternating Current

CD- compact disk

Eskom - Electricity Supply Commission

kWh- kiloWatts per hour

SELF - Solar Energy Light Fund

CD-ROM- Compact Disk Read Only Memory

1.9. Assumptions

It was assumed that educators' training in how to use computers to enhance educators' tasks was offered to educators after the provision of computers. Training was assumed to be appropriate for computer use in educators' tasks and assessed in this study.

1.10. Organisation of the thesis

Chapter 1 describes the problem under investigation, the hypothesis, sub-problems, conceptual parameters, study parameters and assumptions. Further development of the argument regarding computer use in South African schools and the general use of computers by educators and factors hindering their use is presented as a literature review in Chapter 2. The reviewed literature includes findings of other studies on computer use in schools, as well as methodologies that researchers used in computer-related studies in educational settings, to provide the justification for choosing appropriate methodology for this study. The description of the study area and the study respondents has been described in Chapter 3. The research methodology is described in Chapter 4. The study results and their implications are presented in Chapter 5. Finally, Chapter 6 presents the conclusions of the study and recommendations and implications for further research.

CHAPTER TWO
REVIEW OF LITERATURE

In South Africa, computers have mostly been available only to educators and learners in more privileged schools such as independent schools. Pressures from the marketplace for computer literate school leavers have resulted in disadvantaged schools increasingly striving to provide for the technological literacy needs of learners, often in the face of many adversities (Benting, 1999). "In Southern Africa, Headmasters and governing bodies of schools have realised that the technological age has dawned and that their schools should march with the times" (O' Kennedy, 1995b:8). Access to computer facilities is now in evidence in southern Africa, where a few secondary schools have purchased their own computers or received donations for various purposes such as management and administration. However, donations to rural schools are still rare (Benting, 1999; Malan, 1999).

This chapter presents an overview of the literature in the field of the current secondary education situation in South African schools and highlights the transformation of the education system from chalkboard-driven to technology-driven, to discover how computers can enhance educators' tasks in schools in rural environments. This chapter also presents the requirements for effective introduction and use of computers particularly in rural schools of South Africa, so as to explore the factors determining computer use by educators in secondary schools. The reviewed literature is illustrated in Figure 2.1.

2.1. Current conditions and education transformation in South African schools

It is evident that the majority of secondary schools in South Africa are under-resourced in terms of number and quality of educators' qualifications, school buildings and basic requirements for education and learning to take place in the classrooms (Govender, 2000). (See table 2.1). The transformation from the traditional chalkboard-driven education system to a technology- driven education system implies the greater necessity for the provision of supporting physical and human resources for the effective use of technology.
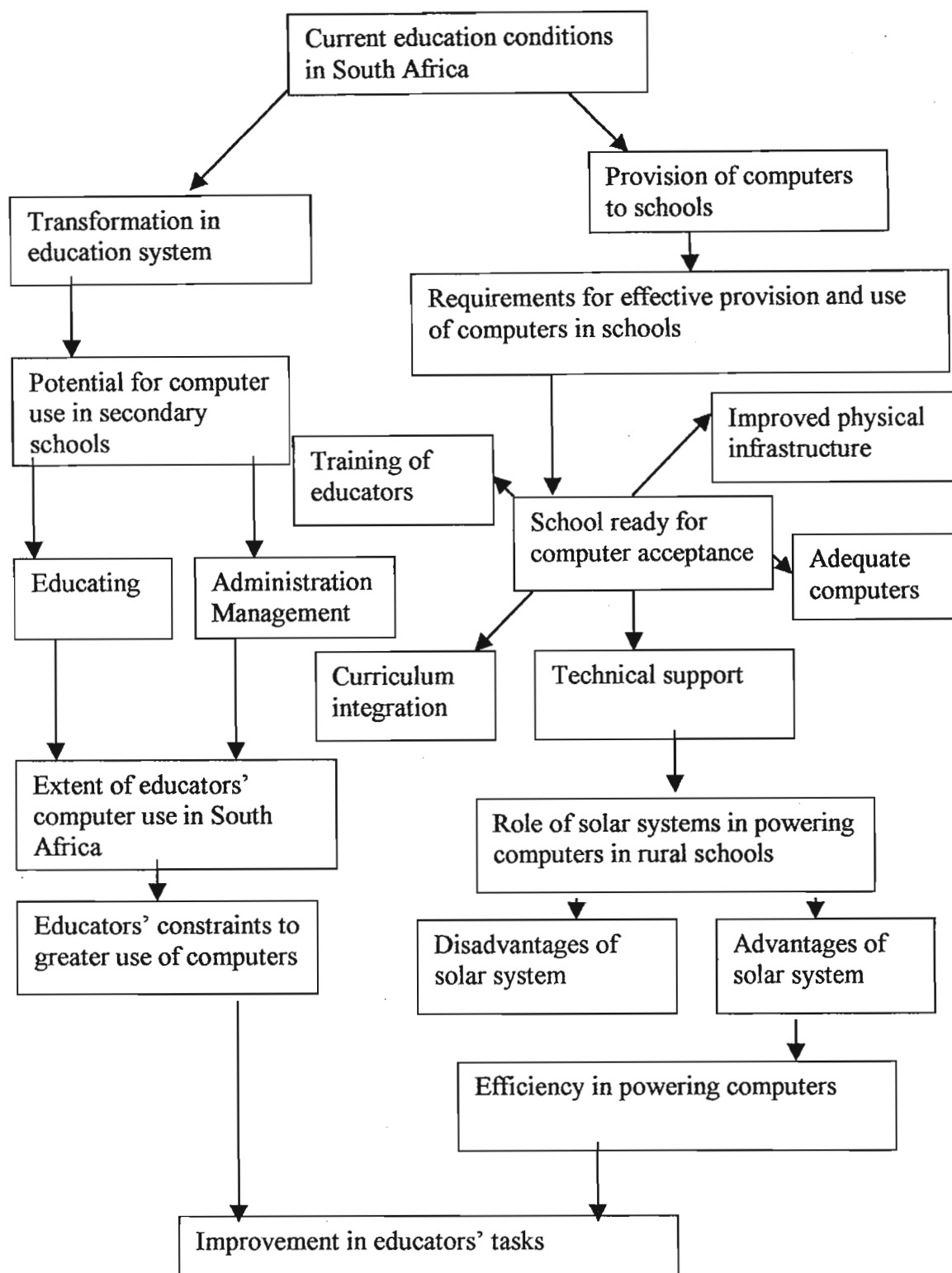
Figure 2.1: Schematic presentation of the reviewed literature

Table 2.1: Resource nature of rural South African schools (Sapere and Mills, 1992; Howell and Lundall, 2000; Kubheka, 2001)

Under-resourced nature of South African rural schools	Resource-based constraints to effective computer use in rural schools
No electricity and telephones	No electricity and telephones
Teaching and learning facilities inadequate	Dilapidated school buildings
Shortage of classrooms	Overcrowded classrooms
Few and under-qualified educators	Educators' lack of computer use training, skills and confidence
	Lack of technical support and schools' remoteness
	Poor security

Most South African rural schools have no electricity (Chetty, 2000). The critical shortage of classrooms is also evident in these schools (Sapere and Mills, 1992). In these schools, educators have to cope with up to 70 learners in a classroom. In addition, educating and learning facilities in terms of buildings, chalkboard and stationery are frequently inadequate (Howell and Lundall, 2000). The generally under-resourced nature (physical and human) of South African rural schools impacts on the effective use of computers. As there is transformation from a chalkboard-driven system to a technology-driven the National Department of Education (NDoE) needs to bring appropriate technology and supporting resources into the classrooms and ensure that educators know how to use the technology (Chetty, 2000).

The year *2000 Schools Register of Needs Report* by the NDoE indicates that there are 27148 schools in South Africa. Fifty-seven percent (57%) of 15474 South African schools have access to electricity while 973 (4%) reported the use of solar power, with almost 642 (65%) solar-powered schools in the Eastern Cape and only one secondary school in rural KwaZulu-Natal. As there is transformation in the education system from the traditional chalkboard-driven educating system to a technology- driven one, 6616 (24%) schools indicated that they have access to computers (used for any purpose including administration, educating and learning). However, this figure (24%) shows that

more than 70% of South African schools are still without computers, but with no rural/urban split in the data indicated (NDoE, 2001). Schools, particularly in KwaZulu-Natal province have low levels of access to electricity and telephone connectivity (Chetty, 2000). As a result, most remote schools in this province are not equipped with essential educational facilities such as computers or other electrical equipment (Chetty, 2000). KwaZulu-Natal has a total of 5701 schools, while very few 342 (6%) have computers (NDoE, 2001).

In KwaZulu-Natal there are 410 rural schools under the King Shaka District Municipality. In this District Municipality, 149 (36%) schools have access to grid electricity, seven use petrol generators and only one school has access to solar electricity (Kubheka, 2001). The statistics of schools with computers from the NDoE do not give the urban/rural split. However, the assumption is that very few rural schools have computer centres as there are very few with access to grid electricity which is regarded as a requirement for effective implementation and use of computers in schools. This implies that research should be conducted to investigate the extent (benefits) to which educators use computers in rural KwaZulu-Natal towards expanding the process of computer provision to rural schools.

2.2. Education Department policy on technology use in schools

The official policy documents issued by the NDoE in 1996 and 1997 seem to completely ignore the potential of technology to enhance the process of education in South Africa (Dudley, 1998). Reading through the 1996 and 1997 White Papers issued by the NDoE, technology is referred to only as a subject to be learnt, but gives no indication as to how computers might be integrated into the educating and learning process of a secondary level curriculum. The word "computer" does not appear once in either of these texts (Dudley, 1998). The Technology Enhanced Learning Initiative (TELI) of 1997 provided a first set of guidelines regarding the role of technology in education. This report served to create awareness of the potential of the various technologies and drew on international experience in highlighting the associated pitfalls (NDoE, 2001). The TELI report (1997) also outlines short-and long-term strategies to implement and sustain computer-assisted educating and learning in South African schools (Dudley, 1998). Special attention has

been given to working within the limits of the country's infrastructure and financial resources and cost-effective models of getting computer hardware, software and telecommunications to schools have been described. South Africa's new curricula (Curriculum 2005) introduced by the NDoE (2000) appear to overlook the findings of the 1997 TELI report. The section of the User's Guide dealing with learning and support materials, reads: "In outcomes-based education, learning support materials facilitate the learning process and encompass more than mainly textbooks only. The support material could include, inter alia, the following: notes/documents, published textbooks, workbooks, supplementary readers and reference book" (Dudley, 1998). Dudley (1998) further mentions that the Web, Internet archives and CD-ROMs have not been explicitly named.

NDoE stresses the transformation from the chalkboard-driven to a technology-driven education system, but its policy documents say little about computers in schools (Matthews, 1999). One success story has been the rapid development and growth of SchoolNet SA. In contrast with government policy-makers, this project (launched in December 1997) has stated its objectives clearly: to bring appropriate technology and the Internet into schools, to develop human resources, content and curriculum and to become the "knowledge backbone" of the country's information highway (Garson, 1999).

It was only in November 2001 that the NDoE, together with the National Department of Communications (NDoC), presented a strategy for technology use in education. These government departments state that extensive provision of computers is, however, beyond the financial resources of the government alone, and partnerships with donors and the private sector will therefore be a critical success factor. The important aspects outlined in this government strategy regarding the introduction of computers in schools are summarized in the following sub- sections (NDoE and NDoC, 2001).

2.3. Provision of computers to South African schools by private stakeholders

In the past, South African departments of education (both national and provincial) were not actively involved in the provision of computers to schools on a large scale (Chetty, 2000). Computer provision occurred through private means, NGOs or donors. Computer

provision to schools were planned and budgeted for by independent stakeholders, under the control of schools' governing bodies. The computer provision ranged from the most basic connectivity of a single computer with Internet linkage to fully networked computer centres (Chetty, 2000). Additional large-scale provision of computers to schools is undertaken by parastatals and private sector involvement. This includes Thintana/Telkom in the Northern Cape, Mobile Technology Network (MTN) in Mpumalanga, KwaZulu-Natal and the Northern Province and Scope in the Northern Cape (NDoE and NDoC, 2001). The standard provision of computers in secondary schools has been to locate the machines in rows on a work surface in a dedicated room, often called a computer centre, which requires educators and learners to come to the computers at allotted times (NDoE and NDoC, 2001).

2.4. Requirements for effective provision and use of computers in rural schools

A key question in introducing technology within a rural context concerns its appropriateness and whether the necessary infrastructure exists to make such technology feasible and effective for use by educators (Govender, 2000). In the South African context, the conditions necessary for the development of computer use by educators centre on access to basic physical and human resources (Howell and Lundall, 2000). The process of acquiring computers requires schools to review the elements discussed in the following sub-sections, which will help them devise a management and sustainability plan that will ensure the successful use of computers by educators in the educating and learning process (Chetty, 2000).

2.4.1. Preparing for the acceptance of computers by school staff

All managers, educators, school governing bodies and other key people of the school management team need to understand the role and value of computer use in the school. Such an understanding needs to include its educational, management and administrative use, as well as issues of cost and sustainability. The school staff need to display a commitment to wanting to and also using computers for the educating and learning process. Such commitment includes the establishment of basic infrastructure (electricity, telephone lines) a safe and secure environment and purchase of insurance (Chetty, 2000).

2.4.2. Improvement in school's physical infrastructure

Physical infrastructure is essential for the effective use of computers in schools. Basic infrastructure requirements such as road access, appropriate power supply, buildings, telecommunications systems, transport systems, equipment and technological hardware must be met as a prerequisite for the effective use of computers in schools (Howell and Lundall, 2000). Relationships need to be established between the NDoE and major infrastructure providers, such as Telkom and Eskom, who could provide essential infrastructure for the effective use of computers (Chetty, 2000).

2.4.3. Appropriate content development for curriculum integration for sustainable computer use in schools

The installation of computers in schools also requires the establishment of an educational network designed to facilitate access to relevant educational information. The value of using computers in the educating and learning process is best realised when appropriate software is developed and used to improve and support the educating and learning process in various subjects. Appropriate software integrated into the curriculum will motivate educators to use computers to enhance their tasks (Chetty, 2000).

2.4.4. Educators training for sustainable computer use in schools

If educators are to become part of the "superhighway of information flow", they need to be introduced to computers, both as an administrative and pedagogical tool. Educators need to know the value of computer use in supporting their tasks (Francis, 1995: 122). Training of educators requires them to understand the application of computers to their tasks. This requires an understanding of the technology, its application to various educating and learning areas and the ability to manage information and knowledge (Govender, 2000). High-quality educator training for computer use should be conducted as an ongoing process, not as a "one-off" approach. Educators need continued practice to become comfortable with computer use and to use them effectively (Garson, 1999; Guhlin, 1996; David, 1999 cited by NCREL, 2000:4).

A study in Chile on computer use in schools found that, after the provision of computers, school Headmasters and educators were invited to a daylong presentation to familiarise them with the aims of the technology brought into their schools (Alvarez *et al.*, 1998). Training of educators was provided over the course of two years, with the first year focused on familiarising the staff with the selected hardware and software. The first year of the Chilean educator computer training took place in the school in order to reach as many educators as possible.

In the second year, the training focused on using the computers to support specific classroom activities and administrative work and to use computers for research and network functions (Alvarez *et al.*, 1998). In short, the training in Chile was quite basic and aimed at familiarising the staff with the computers and introducing them to software (Alvarez *et al.*, 1998). This implies that relevant training needs to be provided to support computer use by educators. Educators often do not know what they can do with computers. The need for advisors to provide ongoing support and a resource base to guide educators is critical. Such support would also need to focus on the use of computers to support and enhance educators' tasks (Chetty, 2000).

2.4.5. Ongoing technical support for computer use in schools

The school environment has to be fully supportive of the implementation, maintenance and use of computers, making available technical assistance and advice to the educators regarding computer use (Gilleran, 2002). The use of computers in schools requires different levels of technical support. The first line of such support needs to be based within the school. This requires the training of educators to undertake the first level of technical support. At least one educator with qualifications for the technical tasks should be made responsible for the computer system, to solve minor technical problems, be in charge of the system disk backup, provide advice to educators less acquainted with the system and request maintenance when a technician is needed (Osin, 1998). In Chile, the educators selected as school-based co-ordinators received additional training in technical aspects in order to strengthen their position as the promoters of the effective use of computers within the school (Alvarez *et al.*, 1998). Further technical support by way of help facilities, contracts with local technicians and companies are also necessary.

This category includes provision of equipment to schools, maintenance and repair (on a technical and advisory level) and involvement in extending computer networks to form a local area network or connecting school computers to the Internet. Computers require constant maintenance and frequent upgrading. Technical staff that look after the computers, including the workstations and file servers, require an understanding of the hardware and software they are installing and the ways in which the computers are intended to be used in the short to medium term. Technical staff should be able to advise on optimal use of the network and sensible upgrades for long-term planning (Chetty, 2000). The three categories of resources required for effective use of computers in rural schools are outlined in Table 2.2.

Table 2.2: Resources required for effective use of computers in South African rural schools (Chetty, 2000; Howell and Lundall, 2000)

Physical resources	Technical resources	Human resources	
		Educating	**Technical**
Access road	Appropriate power supply	Qualified educators in computer use for educating and learning process	School-based technician
Reliable transport	Telecommunication systems		User and network administrator
Appropriate buildings	Adequate hardware		
Safe and secure environment	Adequate software		Curriculum advisor

2.5. Potential computer use in enhancing educators' tasks

The aim of introducing computers into schools is to use them as tools for teaching subject matter, to promote problem-solving and higher order thinking skills, as well use for administration and management (Miller, 1997). Educators can use computer-based tools such as the Internet, text or graphic editors, databases, spreadsheets, or presentation packages, to help in processing information. At Bishops High School in South Africa, the primary aim of using computers was not to teach computer literacy, but rather to use them as devices which would enhance the teaching and learning of various subjects in the curriculum (King, 1999). At Bishops, the framework which was developed, and which

formed the cement for their planning was structured around the following six modes of computer use. Firstly, computers can serve as a tutor and an interactive machine. In this mode, structured learning programmes could be handled through the machine (Selinger, 2000). The tutorial function of the computer also makes it possible for educators and learners to study relatively independently (Merrill, Tollman, Christensen, Hammons, Vincent and Reynolds, 1986 cited by Alant, 1991). A videotape or disc coupled to the computer greatly enhances the communication potential (Blignaut, 1998). This is the mode in which learners could interact with the computer and learn to control and manipulate information (King, 1999). Through a teaching program, a computer could be used to offer a course of study which the learner can follow, interactively and independently of the teacher author (Selinger, 2000).

The Learning Channel also serves as a computer tutor. The Learning Channel is an online learning site designed for learners and educators at the secondary level of education (Lissoss, 2000). This channel provides valuable educational resource material. The educational material is in the form of CD-ROMs. This material covers a variety of secondary school subjects for grade 12. These subjects include Accounting, Biology, History, Geography, Mathematics and Physical Science. This channel is very useful to educators, as it consists of summaries of lessons, diagrams for illustrating, assessment tests and previous examination papers, which makes educating easier. It also provides educators with references which they can use for further referencing (Lissoss, 2000). For educating, the Learning Channel's educational material is used by running a CD on a computer linked to a television, which allows interaction with learners. As this channel covers different subjects, it is useful for rural schools as computers in these schools "are mainly used for Accounting, Biology, Geography, Mathematics and Physical Science" (Madondo, 2000: personal communication).

The second mode is the computer as a communication engine. Here electronic mail can play a very valuable role in creating links beyond the school and classroom walls. Blignaut (1998) suggested that electronic mail and computerized bulletin boards be used on a regional or departmental level. These could be used in communication among schools, educators and learners, on school or study matters. Overseas practice has shown that a system such as this can contribute significantly to the improvement of

communication skills such as reading, writing, spelling, editing, accuracy, organization programming and word processing (Blignaut, 1998). Computers in schools could make it possible for educators to access local and overseas databases to obtain specific information, as well as improving their communication skills.

The third mode sees the computer as a presentation device, one that enhances communication by enabling greater precision of expression and better presentation (King, 1999). An educator could use presentation software to display key graphics, text and numbers in his class lesson and can also use multimedia encyclopaedias. As an educator plans his or her lesson, he or she can type key points into a presentation program such as Microsoft PowerPoint. The important benefit that comes to mind is that educators can enrich their lesson presentations with clear graphics and tables, which can be stored in their computers, easily updated, and be readily accessible for presentation to the whole class by means of a projection device (Rivera, 1999).

The fourth mode involves browsing the Internet for subject information and for communication. The Internet has enormous potential both as a tool for teaching and for supporting educators in their work. The computer is used as a search engine for unstructured information which needs to be evaluated and used (King, 1999). Educators can access data banks in different parts of the country and around the world. Educators who work in isolated environments (like in rural areas), would be able to exchange information with their colleagues, receive advice regarding subject handling strategies from experts around the world through electronic mail (e-mail) and download an increasingly broad array of teaching and learning materials available on the Internet (Osin, 1998).

Fifthly, the computer can be used in a classroom as a learning station. For example, if the topic is science, the computer can be used as a research station to look up information on the Internet, as a data collection station (using scientific probes to collect the temperature of an experimental substance) or as a statistical analysis station (using spreadsheets and statistics formulas). The sixth mode sees the computer as the machine that functions as a data gathering and data processing machine (King, 1999).

In 1998, at Bishops, the computers were used by educators to create a wide range of materials for covering the syllabus for all grades in English, Biology, History, Geography and Art. These materials were being placed on the school's Intranet. Learners were also asked to log on to the Intranet, find the worksheets they had to do, connect to the Internet, if that was asked, prepare oral presentations, using a presentation package and produce all their notes, essays and assignments on a word processor. This made teaching easier (King, 1999).

In addition, computers have the potential to enhance the management and administrative capacities of schools (Asmal, 2001). This is regarded as a very important and useful function of a computer, as it performs routine administrative tasks more efficiently and quickly (Hawkridge et al., 1990). This capacity involves the paper flow of correspondence, internal memoranda, duty lists and other statistical characteristics (Dunn and Morgan, 1987). The range of administrative tasks that computers are used for in school, include learners' records, timetabling, word-processing, accounts and examinations. Educators use computers to improve their administrative efficiency, whether by preparing examination papers with a word processing program or by setting learners' marks using a spreadsheet. Some educators use computers to monitor learner progress through constructing learner profiles (United States of America Congress Technology Assessment, 1995 cited by Howell and Lundall, 2000). In South Africa, 30% of schools that have computers listed administration and management as the most important use of computers by educators in their schools. In schools without computers, 37% indicated management and administration as their priority when they acquire computers (Howell and Lundall, 2000).

In the USA, where 34% who reported using computers in their educating tasks, reported using computers mostly for administrative record keeping, with only 10% reported using computers for lesson plans or to access research (Rowand, 2000). Computers in schools are also used in management functions which require related information or data. Data are collected from all the management areas of the school. The management areas of the school include parents and learners, personnel, media and facilities, extramural activities, finance, teaching and curricula (Ham, 1991). Each of these management areas of the school generates data which should be collected. The collection of data from these

management areas could culminate in a comprehensive database (Basson, 1986 cited by Ham, 1991). This database allows for different users in the school to access the same data. As data collected in this manner can be manipulated, its use may be adapted to the specific needs of each user. Educators can access a learner database, where information about each learner's knowledge map is stored. Such information allows educators to organise more effective learning environments for each learner (Osin, 1998). The possible uses of computers in supporting educators' tasks include searching for subject information, improved presentation of lessons/generating notes summaries, marking assignments and school management activities, as outlined in Table 2.3.

Table 2.3: Potential computer use in enhancing educators' tasks (King, 1999; Bennet, 1996; Ham, 1991)

Educating (lesson preparation & class activities)	Management and administration	
	School	Classroom
Communication with colleagues regarding subject matter	Finance	Word processing
Search for subject information	Parents and learners database	Time tabling
	Personnel	Class lists
Obtain summaries of lessons, diagrams for illustrating, tests and previous examination papers	Educating and curriculum	Learners' records
Improved presentation of lessons-run subject CD on a computer linked to a television	Timetable data - periods per subject	Tests and examination preparation
	Textbook data - lists of books	
	Subject grade and examination	
	Media and facilities	
	Extramural activities	

An additional dimension of computer use in schools is that of educational management. Computers fulfil an important function in automating routine procedures such as timetables, class lists and work scheduling. Through automation of such procedures, computers provide an institutional record which requires minimal change on a daily

basis. A school's database could include aspects regarding what is required from the school in certain subjects (Ham, 1991). Learners' papers also may be of high quality through the use of computers. Instead of just assigning a grade, the educator requests that each paper be typed using a word processor and delivered on a diskette or through e-mail, thereby allowing the educator to insert comments and suggestions and return it to the learner for corrections until a satisfactory paper is achieved (Osin, 1998). Computers allow for effective use of educators' time in more creative and productive ways, by removing the tediousness, drudgery and time-consuming nature of manual administrative processes (Crawford, 1997 cited by Howell and Lundall, 2000).

2.6. Software packages currently used in South African schools with computers

To assess the extent to which educators use computers in schools, educators were asked to indicate which software programs they use and what for. Howell and Lundall (2000) found that word processing software and spreadsheets for administrative purposes are used by more than two thirds of all schools that have computers in South Africa. More than half of the schools with computer facilities (481 of 962) in South Africa use electronic information resources such as encyclopaedias on CD-ROM, while presentation and database software are also used by significant number of schools (Howell and Lundall, 2000). Software that is technically easier to use, shows only minor under-use, whereas software that lends itself to more complex and advanced technical applications tend to be under-used. Examples of the under-utilised software include Presentation software, Drawing software, Simulation software, Database software and Web publishing software (Howell and Lundall, 2000).

This is supported by the findings of a study conducted in the USA, where most educators were found to be proficient in Microsoft Office and used Microsoft Word most (Anon, 1999). In secondary schools, Howell and Lundall (2000) found that greater use of computers in educating and learning tends to occur in technology-oriented subjects, such as Computer Studies. The remaining learning areas in secondary schools appear to be associated with lower levels of computer use. This is reflected in the types of programs used in Pinelands High School in Cape Town, South Africa (Miller, 1997) (see Figure 2.2).
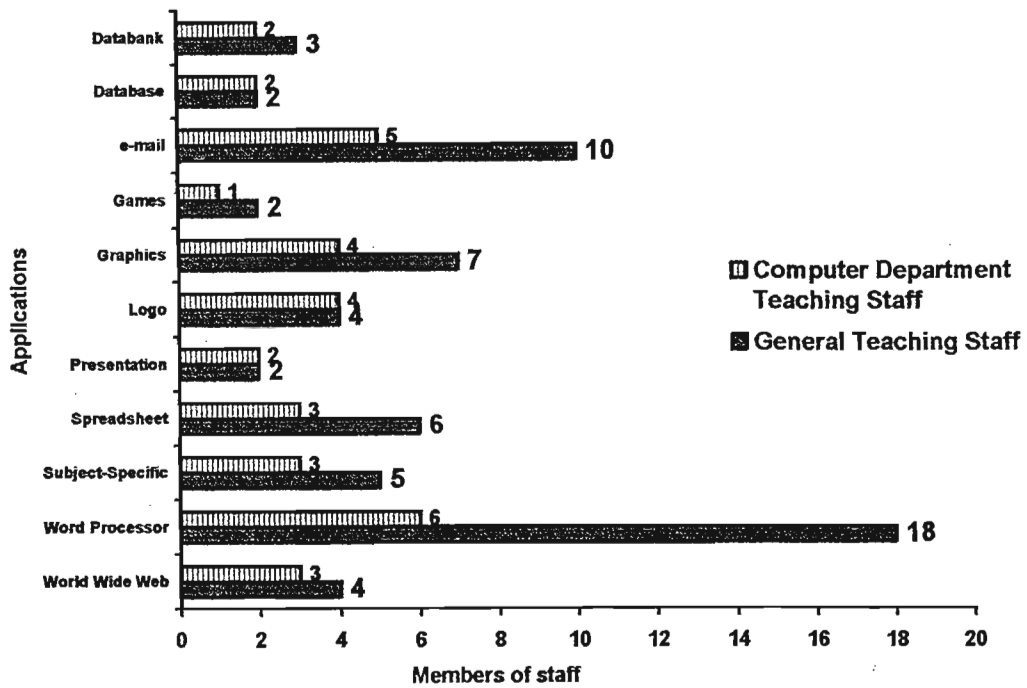
Figure 2.2: Types of computer programs used in Pinelands High School (Miller, 1997).

Figure 2.2 shows that the Word Processor is the most commonly used application and e-mail is also used by a fair number of staff members (Miller, 1997). Schools indicated that the most important purposes for which computers were used were drill and practice. Presentation of assignments and software packages used are outlined in Table 2.4.

Table 2.4: Software packages used in South African schools with computers (Miller, 1997;Howell and Lundall, 2000)

Educating software	Management and administration software
MS Word	MS Word
MS Excel	MS Excel
GroupWise (e-mail)	

2.7. Extent of South African educators' computer use

The progress in the computer age in South Africa has been encouraging, but the gap between the presence of computers in schools and its effective use by educators is still wide (NDoE and NDoC, 2001). The South African Minister of Education, Kader Asmal, says "We can put technology in classrooms but without committed, trained educators, this technology will be of no value. Educators are in the privileged situation to be exposed and trained to use the technology effectively" (Asmal, 2001). International research shows that educators tend to use online communication more for their own correspondence and lesson preparation than the teaching and learning process itself (Garson, 1999).

In South Africa there is much apathy when it comes to integrating computer use into the existing curriculla and Brandjes (1999 cited by Garson, 1999) asserts that most educators do not know how to use computers effectively. In supporting educators' tasks, it is necessary that computers have CD ROM, Internet and GroupWise e-mail. However, a study conducted in South African schools by Cedras and Selikow (1998) found that many schools that do have computers do not have CD ROMs, Internet and GroupWise e-mail. The computers in these schools were mainly used for administration and were seen as having administrative rather than educational value. The educators used computers specifically for recording learners' records and typing examination scripts. This study found that none of the schools had educational packages that could be utilized. These findings show that educators in South African schools generally use computers to enhance administration functions only, regardless of other potential uses of computers in other activities.

2.8. Constraints to greater use of school computers by educators

In order to understand the extent to which educators use computers in their tasks, it is essential to ask educators what they perceive as factors hindering them from using the computers to a greater extent (Howell and Lundall, 2000). Researchers have identified numerous barriers to educators' use of computers in their schools, such as inadequate skills, limited equipment and minimal technical support, and educators' lack of time and

interest. Successful provision and use of technology in schools is still largely dependent on highly motivated, pioneering Headmasters and educators (Lewis, Smith and Jenson, 2001). The lack of appropriate educator training and experience has been identified as a major problem for the effective use of computers in South African schools, particularly in rural areas. Computer literacy is still generally low among educators, the majority lack the necessary training and some lack the appreciation of computers which eventually hinders them from using the technology (Howell and Lundall, 2000).

2.8.1. Limited hardware equipment and minimal technical support

In schools, computers are generally housed in special rooms often called computer centres. These centres have very little available time and space for educators to use the computers or bring in their classes and therefore many educators opt not to use them (Anon, 1999). One Chilean educator explained that, in her school, the limited availability of computers for supporting educators' tasks has discouraged educators from using computers more intensively (Alvarez et al., 1998). Some educators mentioned that those educators who have access or authority to use the computer centre treat it as private property and are unwilling to share (Anon, 1999).

Educators also lamented that if they did want to have a computer session in the computer centre, they would have to prepare two lesson plans: one for the centre, and one for the class if the centre broke down, since their school did not have the resources to provide technical support needed to maintain the hardware and software, and support or train the educators. This was found to be a factor discouraging educators from using the computers (Anon, 1999).

2.8.2. Educators' lack of time and interest in using computers

Educators deliver lessons, manage classrooms, administer tests, discipline learners and assign grades. Educators' time is almost totally consumed by following the prescribed curricula. This discourages even the most creative educators from venturing into new things. While computer availability in schools presents many exciting opportunities for educators, there is no doubt that the current pace of change causes great additional

physical and psychological pressure because there are usually other demands on their time (Chaklain, 1994; Rowand, 2000). Training of educators in computer use must address both pre-service and in-service training (Howell and Lundall, 2000). However, even if educators who want to learn through in-service training and use computers effectively, the lack time, access and support necessary to do so (Guhlin, 1996 cited by NCREL, 2000). Educators often have to use their scheduled planning periods for computer use training, which leaves them behind in their daily work (Anon, 1999). A study of educators' acceptance of technology conducted in South Africa found that educators argued, "We have to finish the syllabus; we do not have time for playing with computers. They have to write examinations and my evaluation depends on their results" (O' Kennedy, 1995b:8). Where schools already had access to computers, more than half the teaching staff were computer shy and lacked interest in using them (Summerly, 1996 cited by Wetselaar, 1997).

2.8.3. Educators' lack of time for Internet browsing

Although schools are provided with computers, very few are connected to the Internet (Asmal, 2001). There is a vast amount of information on the Internet which is able to support educators' tasks. However, educators in Third World countries say it is too time-consuming to sift through the Internet (Anon, 1999). In Chile, the factors that possibly contributed to lack of use of the Internet included the fact that only one computer in the centre had network access, there were technical difficulties reported and educators had received little training in the use of the Internet. As a result, limited access to the Internet and educators' lack of time discouraged educators from using it in any potential way to support their tasks (Alvarez *et al.*, 1998).

2.8.4. Influence of computer maintenance costs on educators' computer use

Schools that have computers, even in First World countries, find that maintenance and upkeep are expensive propositions. In some schools, even in First World countries, there has not been adequate investment in technical infrastructure required to maintain the computers (Anon, 1999). In Third World countries, schools have been striving to provide for the technological literacy needs of educators and learners, often in the face of many

adversities and at the expense of other priorities (Benting, 1999). The learning community in rural public schools is particularly reliant on donated computers or refurbished ones and it is often the sector with the lowest in-house technical capacity for decision-making, especially concerning intended educational use of the computers (Benting, 1999). Some people argue that computers are not, in fact, that expensive and there are many people willing to give them away as donations. The question to ask about such donated refurbished computers is whether they solve problems or produce them, because some schools have technology equipment in place that costs money to set up and maintain. Computers that often break down have little educational value and take up educators' time when they have more important things to do (Mechanic, 1998).

Many schools do not realise that there are additional financial issues involved in the implementation of computers in schools such as security, maintenance, paying telephone bills and fund-raising for expansion of their use. Using the Web may cost more money than poor schools can afford (Brandjes, 1999 cited by Garson, 1999). The cost for maintenance and repair of hardware varies from school to school and it is difficult to generalise about how much money is spent on this. Often 50% to 75% of donated hardware has serious breakdowns, which require a substantial investment of time and expertise to remedy (Benting, 1999). The expertise to do technical repairs is more likely to be absent at schools and proves expensive when the service has to be purchased. This becomes especially costly for schools located further away from the larger city centres, where support is readily available. Daily computer breakdowns caused by lack of maintenance discourage educators from using the computers (Alvarez *et al.*, 1998).

Looking at educators' perceptions about computer costs, Dunn and Morgan (1987) found that educators worry about the cost of the system, the effect of this on the overall school budget and about its effects on their resource needs. In a study in China (1990) on educators' views on the introduction of computers, different arguments related to cost were presented. Educators argued "Why should scarce space be used up by machines, why should computers be air conditioned, money would have been better spent on items such as scientific apparatus" (Hawkridge *et al.*, 1990: 276).

Hawkridge *et al.* (1990) found that Malaysian educators were not happy about being faced with problems arising from hardware breakdowns which they were seldom qualified to remedy. Zimbabwean educators had glum stories about computers breaking down and being affected by dust and humidity. Because computer maintenance is vastly expensive for rural schools, educators fear that they will damage them and this seriously inhibits the use of computers (Benting, 1999). In the previous sections, the requirements for effective provision of computers in rural South African schools and their potential use by educators have been discussed. One of the requirements for effective use of computers in schools is power supply, which is inaccessible in rural South African schools. In the following section an alternative system with the potential to generate electricity to power computers in rural schools is discussed.

2.9. Role of solar energy in rural schools

Education of rural communities is an important national and international priority. However, in many countries, the availability of electricity to support rural educational activities is inadequate (Jimenez and Lawand, 2000). In recent years, the development of reasonably priced and reliable renewable energy systems has made it possible to provide solar electricity to schools in rural areas (Hankins, 1995). Solar electricity is electric power generated from sunlight using devices called solar cell modules or photovoltaic (PV) modules. Solar electricity can replace some applications of lead accumulators, petrol-fuelled generators and even grid power. Power is generated on site by photovoltaic equipment and is stored in lead accumulators. From the batteries it is supplied to the appliances. Combined with a battery, a charge controller and wiring, a PV module can be combined into a Solar System (Hankins, 1995) (See Figure 2.3). Schools in rural areas use solar electricity to power computers, typewriters, lights, sewing machines, calculators, light tools and security systems (Hankins, 1995). A number of international, national and local institutions, non-governmental organisations, foundation, and private companies support the deployment of solar systems in rural communities in the developing world (Jimenez and Lawand, 2000). Despite increased donations of solar systems for rural schools, such projects remain under-funded. In many countries, operation and maintenance of existing services to schools often occupy most of the

schools' budget allocation, leaving little for upgrading rural schools with renewable energy systems.
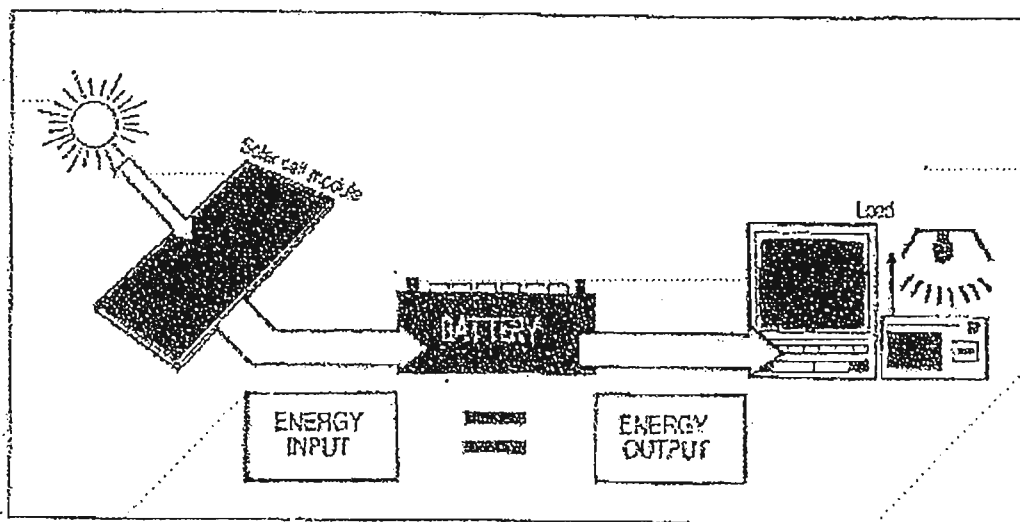
Figure 2.3: Energy input from the solar/PV module to the appliances (Hankins, 1995).

In assessing whether is it worthwhile installing solar electric systems specifically in South African rural schools, the advantages and disadvantages of solar electric system installation and use specifically in rural communities are outlined in Table 2.5.

Table 2.5: Advantages and disadvantages of solar energy (Hankins, 1995)

Advantages	Disadvantages
Can power computers, typewriters, lights, sewing machines, calculators, light tools and security systems	Initial installation cost very high
	Batteries must be carefully maintained
Consumes no fuel	Lack of trained technicians for installation and maintenance
Requires inexpensive maintenance	

There are few rural schools with access to grid electricity in South Africa, yet educational technology requires the existence of electric technology. The advantages of solar electricity thus become evident. Its potential to power computers outweighs its disadvantages, although the initial installation cost is very high. The potential of solar electricity to power computers implies that technology-driven education could also effectively take place in rural schools, provided the necessary resources are in existence. The following discussion reflects the methodologies used by various studies to investigate computer use in schools.

2.10. Research methodologies used in educational research

In the field of research, there are intense debates regarding appropriate research methods, especially concerning the use of quantitative and/or qualitative approaches (Hammersley, 1993). Many researchers felt that what quantitative methods alone could not deliver, qualitative methods or both qualitative and quantitative methods could be used to in address the same issue (Lemmer, 1992). The use of qualitative research in educational settings allows access to unintended outcomes, as observers working "in the field" are able to access hidden data that is the information from the actors (Headmasters, educators, administrators and learners) which is both unintended and unexpected (Lemmer, 1992:293). The focus of this section is on various research methodologies used by researchers to collect data in computer-related studies in the school setting.

2.10.1. Survey research methodologies employed in studies regarding computer use in schools

Survey research in schools involves the collection of information from educators or other persons associated with the educational process, learners and the analysis of this information to investigate important educational issues. A combination of data collection techniques may well enhance a researcher's depth of understanding of those under study and their circumstances, in a way that may not occur, where a technique from one paradigm is not complemented by one from another (Rosier, 1987 cited by Taylor, 1990). However, one needs to be clear about the type of information that a technique from a particular paradigm is capable of yielding (Taylor, 1990). Howell and Lundall (2000)

employed a combination of quantitative and qualitative research methods to investigate how educators made use of school computers in South Africa. In this survey, by Howell and Lundall (2000), significant amounts of quantitative data were collected from educators through a survey questionnaire. The qualitative data through interviews with schools' Headmasters and site visits to schools were also collected. This presents a good example of combining two techniques for one study in a school environment. This combination could also be used in discovering the extent to which educators use solar-powered computers in a rural school, so as to obtain supporting and deepened data. A South African study on computer integration in secondary schools used interviews with the Headmaster of the school, in addition to the questionnaire, specifically to corroborate information in the questionnaires (Miller, 1997). Survey questionnaires were also used to capture data from educators regarding their confidence in the use of computers across the curriculum and balance of skills amongst staff. The school Headmaster was interviewed regarding fitting computer use expenditure into school budgets, fundraising and attitudes towards computer use at the school (Zwimpfer, 1997).

2.10.1. Characteristics of qualitative research- observations and interviews in schools

Some researchers carry out observation in schools with notepad in hand to collect their data (Bogdan and Biklein, 1992). Others rely on video equipment in the classroom and never conduct research without it. Even when equipment is used, however, the data collected on the premises is supplemented by the understanding that is gained by being on location. In addition, mechanically recorded materials are reviewed in their entirety by the researcher, with the researcher's insight being the key instruments for analysis (Bogdan and Biklein, 1992).

In a Chilean and Costa Rican study on computer use in schools (Alvarez *et al.*, 1998), data were gathered in both schools on the perceptions and opinions of educators regarding computer use. In each sampled school, two classrooms where educators were using computer-based technology were observed. The observations focused on recording the specific applications and the pedagogical methods used when applying the technology (Alvarez *et al.*, 1998). As qualitative research allows the combination of techniques, the

researchers on the Chilean and Costa Rican survey also interviewed school Headmasters and educators, to gather data on the individuals' professional and technological backgrounds, their management and educating style and their perceptions of the impact of computer use on the school.

2.10.3. Focus group discussions for computer-related studies in a school environment

Anon (1999) used Educator Focus Group sessions to gain a greater understanding of educators' views on the technological environment in which schools were operating, the ideal environment for undertaking a collaborative effort and potential challenges and opportunities facing them, educators' access to Internet, how frequently they used it and for what. In these studies on computer use in schools, all variables were analysed by descriptive statistics, that is frequencies. Miller (1997), Zwimpfer (1997), Howell and Lundall (2000), Rowand (2000), captured and coded the data on computer use in schools, collected through questionnaires, focus group discussions and observations, to ascertain the overview of frequencies and general trends in responses.

2.11. Summary

Chapter 2 has provided background information to build on what other researchers have discovered concerning the topic of computer use in secondary schools. The argument presented in this chapter is that the NDoE calls for transformation in the education system from chalkboard-driven to technology- driven education system. However, the NDoE says little about the use of computers in schools and has not been actively involved in the provision of computers, nor has it designed educational software for curriculum integration. The review of literature highlights the fact that the provision of computers to schools has been through private sector donations and shows the realisation by the Headmasters and school governing bodies of the importance of computers in their schools. Regarding the extent of computer use by educators in schools, literature indicates that educators use computers for educating, administration and management tasks.

Human resource development, physical environment improvement and maintenance costs have been discussed as the main factors determining the use of computers, particularly in rural schools. This chapter has also presented research methodologies used in educational settings so as to provide background information as justification for the selection of a suitable research methodology for this study. The picture presented here is that in spite of the dominance of quantitative research in education, the use of qualitative methodology has a considerable contribution to make to educational research. Qualitative research methodologies, with all their techniques, seem to be appropriate in conducting research in rural schools. The main data collection technique that researchers in studies of computer use in schools employ is the survey questionnaire. To support the data collected through survey questionnaire these researchers also used focus group discussions, interviews and observations of computer use at the schools. On the basis of the reviewed literature and the exploratory nature of this study, both the quantitative and qualitative methods will be employed.

CHAPTER 3

DESCRIPTION OF THE STUDY AREA AND RESPONDENTS

3.1. Myeka High School and its solar technology development

Myeka High School is a rural public high school founded in 1980. The school is located in the KwaZulu-Natal rural midlands village of Maphephetheni in the Ndwedwe district, under the leadership of Chief Frank Gwala. Myeka High School is marked number 2 on the aerial map of Maphephetheni (see upper left hand corner in Figure 3.1). Myeka High School is one of three high schools in Maphephetheni, none of which are connected to the national electricity grid (Cawood, 2001). The terrain is very mountainous and Myeka is characterised by its remoteness, unreliable public transport, lack of grid electricity, lack of telephones and poorly maintained dirt roads, which are impassable when wet.
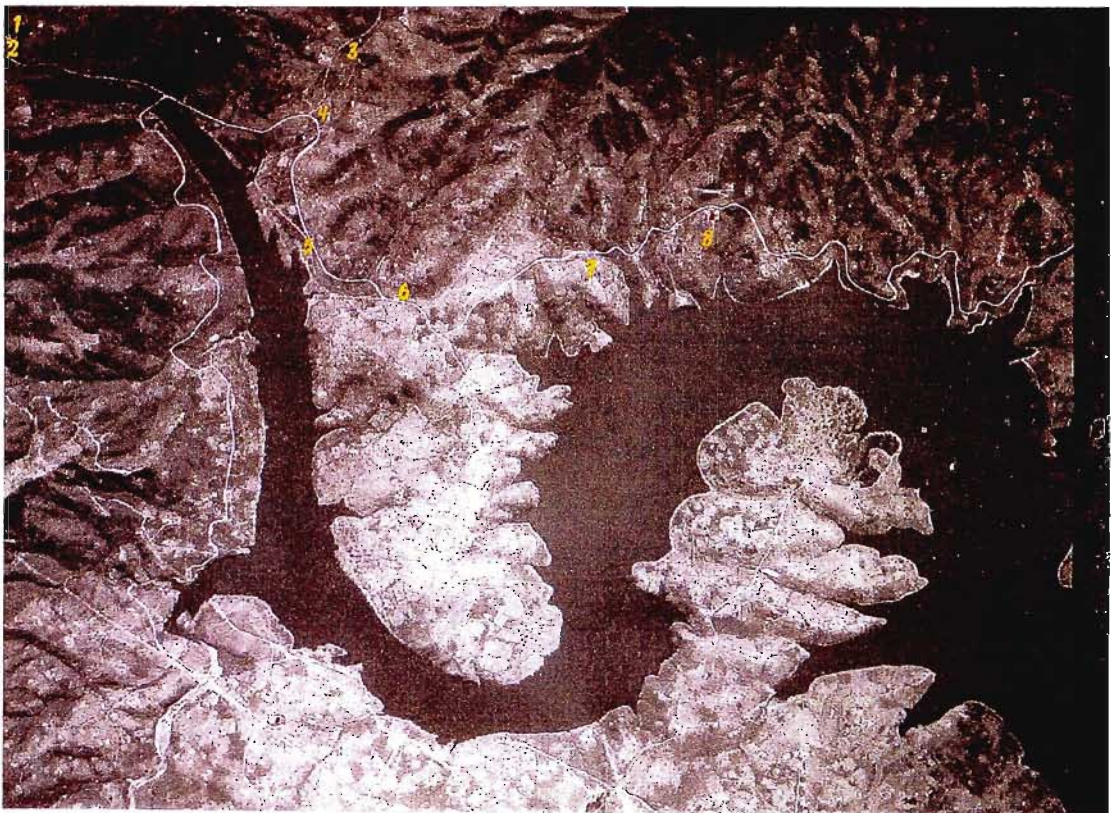
Figure 3.1: Aerial map of Maphephetheni area (Cawood, 2001).

Before 1996, this school had no access to computers, photocopiers, overhead projectors and telecommunications, which are generally regarded as standard in assisting educators' tasks (Witherden, 2000). Through private funding, this rural school was equipped with

solar-powered technology to support its energy needs. The solar (Photovoltaic or PV) technology installation began at Myeka in 1995. The installation of the solar systems was funded by an American-based energy organisation, (SELF), and managed by SES as the representative of SELF in South Africa (Cawood, 2001).

The Electricity Supply Commission (Eskom), the national electricity supplier in South Africa, installed the first pole-mounted solar (PV) system in Myeka High School as part of its rural schools electrification programme in 1995. The system was vandalised and the panels stolen, but was restored in 1997. The present Eskom solar system at Myeka High School consists of 14 Helios panels generating 51 W, which are connected in series-parallel to have a maximum output of 714W (Kempenaar and Wiersma, 2000).

The Eskom solar system initially provided power to the Headmaster's office computer and the lighting in the Home Economics centre. The installation and repair of the solar system at the school by Eskom led to the school purchasing an overhead projector. The overhead projector was reportedly seldom used due to the high cost of overhead transparencies. The lights at the school were also unused, as the school seldom conducted activities at night. The Headmaster had a vision of operating a computer centre at the school with the Eskom solar system (Cawood, 2001). In order to make the Headmaster's vision of operating a computer come true, SELF persuaded DELL and Infosat to donate computers and the satellite link at the school so that educators and learners could have Internet access (Lipschultz, 2001). As a result of SELF's request, DELL donated five computers, while Unilever donated 15, which led to the opening of the first rural 20-computer centre at the school, in 1998. Three of the 20 donated computers had Internet access installed by InfoSat Company. SELF donated five printers, a scanner, a Compact Disk copier and a photocopier to the school. The University of Durban-Westville donated a Weather Station. The school bought two photocopiers, four 74cm television sets and a video recorder to be used by the educators. Although the school has acquired many technological facilities, they remain unused because the Eskom solar system could not supply sufficient power to operate them. As a result, Mangosuthu Technikon installed a solar/gas hybrid system in mid 1998 at the request of SES. This system was installed in order to supply power exclusively to the AC plug points in the computer centre and the adjacent photocopy centre at the school. The

solar panels of the solar/gas hybrid system comprise 8 x 85 W BP panels configured to deliver 680 W. This system also comprises a 2.4 Kw inverter, a 750 W battery charger and a 4.5 Kw gas generator. The total solar input from these three arrays totals 2.5 Kw. The solar/gas panels are attached to a separate battery bank that consists of 12 x 12 volts Willard deep-cycle batteries.

To accommodate the additional power needs at the school, the Shell Renewables Company donated the second pole-mounted solar array, consisting of 14 x 75 W panels, in late 1998. This solar system was installed and configured to provide 105 Kw by SES. Both the Eskom and Shell solar systems deliver power to one battery bank. The solar power from the Eskom/Shell battery bank is then delivered to the Home Economics centre, Physical Science laboratory, Resource centre, Headmaster's office, Head of Department's office and for lighting in the school classrooms. Therefore there are three solar arrays installed on the side wall of one of the six single storey buildings at Myeka High School. One of these solar arrays has a gas backup to supplement solar energy supply (Figure 3.2).

An energy audit by Kempenaar and Wiersma (2001) of all the existing loads at the school indicated that the panels could supply 75% of the load, thus requiring the generator to deliver 25% of the needed power. The 4.5 kW generator therefore runs for at least an hour per day to complement the solar energy (Kempenaar and Wiersma, 2000). There has been a proposal from ML Sultan Technikon to provide the school with necessary infrastructure and technical assistance, where possible. This assistance would take the form of personnel, equipment and possibly financial contributions (Kempenaar and Wiersma, 2000).

Figure 3.2: Solar/Gas Hybrid System at Myeka High School, 2000.

3.2. Myeka High School resources

Myeka High School is characterised by the following human and physical resources, as observed at the school: 24 educators, including the Headmaster, who also teaches part-time and the secretary responsible for the school administration. There are 22 black and two Indian educators, of whom 14 are females and 10 males (Table 3.1). These educators are responsible for 845 learners. Educators at Myeka High School obtained their educational qualifications from colleges of education and universities in South Africa.

TABLE 3.1: Characteristics of Myeka High School educators (n=24)

Race		Gender		Home location		Institution at which qualification obtained		Computer qualification	
Black	Indian	Female	Male	External	Local	*College	*University	Diploma	None
22	2	14	10	23	1	13	7	2	22

* Four educators obtained their educational qualifications from both college and university.

Only two educators have pre-service diplomas in computer training, received at tertiary institutions in KwaZulu-Natal. Twenty-three educators commute daily from peri-urban and urban communities surrounding Durban city to school using unreliable public transport, with only two educators using their own transport. The educators at Myeka High School have two to 20 years of experience and have been at Myeka for up to 18 years (see Table 3.2). Five educators (20.8%) are fairly inexperienced, with five years or less of teaching experience.

Five educators (20.8%) are fairly inexperienced, with five years or fewer of teaching experience. This shows a fairly experienced educator corps, which may take advantage of the new technology. On the other hand, the 21% more recently qualified educators may also be keen to use the new technology. The largest group of 11 educators (45%), as indicated in Table 3.2, have been educating in this school for between six and ten years. This indicates that this is a stable teaching population, which could provide valuable information about the school.

Table 3.2: Myeka High School educators' educating experience (n= 24)

Educating experience (years)	Number of educators (Overall experience)	Number of educators (Experience at the school)
1-5	5	8
6-10	7	11
11-15	6	2
16-20	5	2
Just started (March 2001)	1	1

The school has six single storey buildings, which include the computer centre, Home Economics centre, Head of Departments' (HoD's) office, Physical Science laboratory, photocopy centre, a Headmaster's office, a staff room, a resource centre, a library and 16 classrooms (Table 3.3.). The Home Economics centre, HODs' office, the Headmaster's office and the resource centre are linked to the two pole-mounted solar arrays to provide

energy to power the equipment in these rooms. The staff room, library and 16 classrooms receive power from these panels for lighting only. The power to the computer centre and adjacent photocopying centre is provided by one solar (PV)/gas generator hybrid system. The school library is resourced with books donated by the Valley Trust and a European Union grant. The school has one treated water standpipe, which was installed by Umgeni Water. The water is used for drinking, sanitation and for home economics practical classes. The school is securely fenced and there is one security guard responsible for the safety and security of the school's resources, especially the technological facilities located in five centres, as outlined in Table 3.3.

TABLE 3.3: Location of technological facilities in Myeka High School

Centre	**Technological facilities**
Computer Centre	Five Central Processing Units (CPU's) 20 workstations One 74cm colour television set Three printers.
Home Economics Centre	One computer, including a CD-ROM One 74cm colour television set for teaching purposes
Photocopying centre	One overhead projector Two photocopiers
Physical Science laboratory	One computer, including a CD-ROM One 74cm colour television set
Headmaster's Office	One PC with Shareware linked to adjacent Head of Departments' office workstation One printer
Resource Centre	One PC Three workstations with Internet access One printer One scanner One photocopier
Outside the computer centre	One satellite dish installed on the school ground to facilitate the Internet access.

Myeka High School uses a Toshiba 17.10 photocopier, which draws excessive power from the power source. When this photocopier is in use, there is not enough power left for using the computers. This creates disruption in the educator and learners' schedule for using computers. The Toshiba photocopier has surge wattage of 1500, which causes the solar (PV) power system to run down frequently, as it is not designed for such large loads (Kampenaar and Wiersma, 2000). The school has recently obtained other photocopiers, which are now used more often and draw less power.

Myeka High School has a variety of software programs installed by two companies in the 20 computers that the staff could use for computer-based activities. These software programs provide the school (educators and learners) with learning materials and connectivity. All the PCs in the school have MicroSoft (MS) Office Programs (Word, Excel, PowerPoint and Access) installed, running on the Windows 98 operating system. In addition to the MS Office Programs, there is also software that is linked to the solar-powered weather station, situated in the grounds of the school. InfoSat, one of two satellite connectivity companies in South Africa, achieved full connectivity at Myeka to the Internet. The 'server' computer at Myeka is linked to a GSM modem, which sends a data request by Yagi aerial and cellular networks, to InfoSat in Johannesburg. From there, the requested data is broadcast back to the Myeka server via satellite (Austin, 2000).

The Learning Channel is an online learning site designed by the Learning Channel Campus in Johannesburg for learners and educators at the secondary level of education. The Learning Channel provides a full range of educational materials. This database of information, accessible in the Learning Channel, is stored on Myeka's server in the computer centre and accessible on www.learn.co.za. This database is updated periodically by a data-casting broadcast via satellite. This server also supports a CD Writer, by which this database is written onto CD-ROMs. Therefore the school has a portable CD-ROM Library of Learning Channel material, as well as other materials downloaded from the Internet. Educators can extend the use of this CD-ROM library by running the desired CD on one of the three educator PCs in the home economics centre, physical science laboratory and resource centre. Each of these PCs is linked to a 74cm colour television set. The educators can take the relevant CD to one of the classrooms

with a television set and view it on the screen. This information is written to the hard drive, thus making the information for certain subjects permanently available in each of these classrooms. In this way the library is available to the educators and the learners, by simply running CD-ROM or accessing the information on the server itself (Austin, 2000). The list of organisations and institutions that contributed to the solar technology development, technological facilities provision and educators use training at the school is found in Appendix A.

Schooling at Myeka starts at half past eight in the morning and ends at half past two in the afternoon. The six hours schooling programme also places demands on the school's power systems. There are 19 subjects offered at the school, as shown in Table 3.4. The provision of solar technology to the school has the potential to improve the presentation of lessons in all the subjects listed in Table 3.4.

Table 3.4: Subjects offered at Myeka High School

Accounting**	History
Agricultural Science	Home Economics
Biology*	Industrial Art
Business Economics*	Mathematics*
Catering and Hotel-keeping	Physical Science
Computer Literacy**	Speech and Drama
Economics	Technical Drawing
English**	Travel and Tourism*
Geography**	Typing
	Zulu
* subject educators actually using computers in classrooms	
** subject educators using computers in the centre.	

3.3. Summary

The present study forms part of a wider investigation into the functioning of the solar technology at Myeka High School from the community outreach, technological and learners' perspectives. The study focuses on investigating the extent to which Myeka High School educators use solar powered computers and the determining factors encouraging and discouraging computer use. The description of the study highlights its rural location, characterised by lack of electricity, lack of telephone lines and poorly maintained dirt roads.

The characteristic of the school's resources in terms of its lack of access to the services required for computer use means that the computers in the school are solely powered by solar systems, with gas backup. A large number of educators have been at the school for a period of six to 10 years. This indicates that a large number of the study respondents (educators) have seen the technological developments taking place at the school. These educators could provide valuable information about the factors motivating them to, or discouraging them from, using the solar-powered computers in their school. The school's access to the computerised learning materials, connectivity and educators' training indicate that educators can make use of the computers for their tasks. This calls for an investigation into the extent to which the educators use computers and determine factors encouraging and discouraging computer use. The next chapter describes the research design and methodology used to collect data for this study.

CHAPTER 4
RESEARCH DESIGN AND METHODOLOGY

4.1. Introduction

This study aims to investigate the extent to which educators at Myeka High School use solar-powered computers for their educating tasks. The first sub-problem of this study aims to investigate the educators' use of computers in terms of their computer skills levels, software types and time spent on computer use at the school. The second sub-problem aims to investigate whether Internet access and training increase educators' motivation to use computers for their tasks. The third sub-problem explores the key factors determining computer use by educators at the school.

Chapter 4 describes the research design and methodology selected and used to collect data on the extent to which educators at Myeka High School use solar-powered computers. This chapter gives the justification for the selection of a research methodology suitable for this study, through giving references of research methodologies chosen from international and national studies that investigated the use of computers in schools. The selected data collection techniques and their implementation, following the provision of computers and educators' training on how to use the computers at the school are outlined in Table 4.1. Before the data were collected, the initial contact had been built with the school through previous ongoing research in the Maphephetheni area. Permission to conduct the study was sought from the local Chief (Frank Gwala) and from Myeka High School Headmaster (Melusi Zwane).

4.2. Data collection techniques

The research methodology used for this study is survey research. Survey research was selected because it allows a combination of a variety of data collection techniques for one study (Gibson, 1990). A combination of quantitative and qualitative data collection techniques was used in this study, through two questionnaires, distributed before and

after Internet Explorer installation, weekly observational visits, informal interviews and focus group discussions with the educators. Combining these techniques overcame the deficiencies of each approach to obtain a true perspective of educators on the same issue, which is the extent to which they use solar-powered computers. A combination of quantitative and qualitative techniques, as suggested by Howell and Lundall (2000), enhanced the researcher's depth of understanding of the educators under study and their circumstances, in a way that may not occur where a technique from one paradigm (quantitative) was not complemented by one from another (qualitative) (Hammersley, 1993).

TABLE 4.1: Technological development events and data collection timetable at Myeka High School

Dates	Events and data collection
1995-1998	Installation of the solar systems by SELF, SES, Eskom, Shell and the Mangosuthu Technikon
1998	Provision of technological facilities to the school by SELF, DELL and Unilever
1998	First MS Word and Excel training to educators by Valley Trust
2000 (April)	First questionnaire distribution to the educators by the researcher
2000 (May)	Computer use monitoring sheets pasted on the computer centre room by the researcher
2000 (June)	Internet Explorer installation at the school by InfoSat company
2000 (August)	First training on Internet Explorer use and second training on MS Word and Excel use to educators by the Valley Trust
2000 (September)	Second questionnaire distribution to the educators and the secretary by the researcher
2001 (March)	Focus group discussions with the educators conducted by the researcher
2001 (May)	Interview with the school Headmaster conducted by the researcher

4.2.1. Quantitative data collection technique - survey questionnaire

The present study employed survey questionnaires consisting of open and closed questions, as suggested by Zwimpfer (1997). The survey questionnaires were distributed

to the school staff (the 24 educators, including the Headmaster) before the Internet Explorer was installed. The questionnaires were used to capture data regarding the extent to which educators use solar-powered computers and determine factors affecting computer use. With regard to computer use, educators were required to state their teaching experience, the extent of computer use after training in terms of the types of programs used and what they were used for and time (in hours) spent on using computers per week. A copy of Myeka High School educators' pre-Internet Explorer survey questionnaire is found in Appendix B. After the Internet Explorer access and training on Internet Explorer use, and a second training sessions in MS Word and MS Excel, the second survey was carried out. The aim of administering the second questionnaire was to find out whether Internet Explorer access and training increased educators' extent of computer use for their tasks (see sub-problem two). A copy of educators' post-Internet Explorer questionnaire is found Appendix C. One post-Internet questionnaire was administered to the newly appointed secretary to assess the extent to which she used the school computers. The secretary's questionnaire is found in Appendix D. The survey questionnaires were pre-tested for accuracy with a university student, to highlight problems and ambiguity. Using a student was the last resort, because the study area was the only rural school with solar-powered computers in the province, so educators with the relevant experience were difficult to find.

4.2.2. Qualitative data collection – observational visits and informal interviews

In collecting qualitative data for this study, the researcher spent time at the school during random observational visits, observing whether educators were using computers and which programs they used. Additional data on factors affecting use was gathered through informal interviews with educators found using computers in the computer centre.

To ensure additional information collection on computer use while the researcher was not at the school, the researcher designed computer use monitoring sheets which were then pasted on the wall of the computer centre at Myeka High School. These monitoring sheets were designed to capture information on the extent to which educators used

computers and the peak times at which they were used. On the monitoring sheets educators were asked to indicate their names, date, time spent on using the computer (in hours), type of computer program used and the purpose of activity. A copy of Myeka High School computer use monitoring sheet is found in Appendix E.

4.2.3. Focus group discussions with the educators

The researcher conducted three focus group discussions with the educators in the school's computer centre. The questions for focus group discussions were designed to move from general to specific and were categorised into three aspects: extent of educator use of computers, educators' perceptions about computer use and the effects of computer maintenance on computer use. The aim of conducting focus group discussions was to understand how educators use computers, their perceptions about using computers in their rural school and the effects of computer maintenance on computer use, as well as discouraging factors to greater use of computers. A copy of focus group discussion topics is found in Appendix F and permission request letter found in Appendix G.

The focus group discussion technique was selected, because a study investigating educators' access to computers and the Internet, how frequently they used them and for what purpose had used focus group discussions successfully (Anon, 1999). The selection of focus group discussion technique is also justified by a study on computer use in schools, which used focus group discussions to gain greater understanding of educators' views on the technology environment in which schools operate, the ideal environment for undertaking a collaborative effort, potential challenges and opportunities facing them (Anon, 1999). Focus group discussions were particularly useful in this study because they allowed greater depth of understanding of the situation under which educators used the computers. Ideally, a focus group should be relatively small, comprising six to eight people (Macun and Posel, 1998). The respondents for focus group discussions were selected on the basis of the time they spent on using school computers:

- Computer users group. This group comprised three of the five educators who indicated that they used the computers for four to ten hours in a week

- Computer partial users-composed of five educators who indicated they used the computers for one to three hours per week.
- Computer non users-composed of ten educators who said they did not use the school computers but mentioned a willingness to use them in the near future.

Although the groups interacted very well to produce the in-depth information concerning computer use to supplement the questionnaires, two of the three groups were very small (three and five attendants, respectively). This resulted in data being unable to be analysed by a computer program and they were visually inspected instead. Documenting the concepts extracted from the educators' responses were tabulated and compared between the three groups.

The discussion-generating questions were presented in a similar fashion to all three groups. The questions were loosely framed so as to draw out various perceptions and opinions. The respondents were probed to give more valuable/additional information through questions stemming from given brief responses. Non-talkers were encouraged to participate through calling on them by their names, to give their views or add on to what others had said, so as to bring about a balanced discussion environment. To motivate all the respondents to participate they were asked, as a group, to compare different advantages and disadvantages of computer use in their rural school, and prioritise three advantages and disadvantages perceived as the most important. The use of focus group discussions in this study allowed each respondent to expand his or her perceptions by sharing and comparing them with those of others which resulted in obtaining valuable data.

4.2.4. Interview with the school Headmaster

The aim of conducting an interview with the school Headmaster was to discover the effects of computer maintenance costs on the school's budget and computer use, as well as to corroborate the data on computer maintenance collected through focus group discussions with the educators, as suggested by Zwimpfer (1997). The overall aim for conducting the interview with the school Headmaster was to discover the key factors

determining computer use by the educators (see sub-problem three). A copy of the Headmaster's interview questions is found in Appendix H.

4.3. Data analysis

The survey information was measured, summarised in terms of percentages of respondents and displayed in graphs and tables in Chapter 5. Responses given to open questions of the pre- and post- Internet Explorer installation questionnaires were first grouped into categories and translated into numerical codes. The coded data were then entered into the Statistical Package for Social Science (SPSS) spreadsheet (Windows version 9.1) for descriptive analysis (found in Appendix I). The analysis of data collected through focus groups was done through manual inspection of the data. The contents of statements from focus group discussions were carefully studied and categorised. Where the words were similar or carried the same meaning, but put differently, the researcher exercised judgement to put them together into one category or keep them separate (See Appendix J). This data reduction was carried out because it helps to identify important aspects of the responses given by the respondents, and to categorise them for the purpose of analysis (Sarantakos, 1998). Data collected through observations, informal interviews and the school Headmaster interview were analysed by manual inspection.

4.4. Summary

Chapter 4 outlined the research design and the methodology used to collect data from the school staff. The data collection timetable was presented to emphasise the fact that data collection was conducted following certain technological and human development aimed at the use of computers by educators at the school. The justification for the selection of a suitable research methodology for this study, based on research methodologies used in studies investigating the similar issue of computer use by educators in schools, was presented. Data collection techniques used, analysis and interpretation of data were discussed. The next chapter will discuss the results of the data collected.

CHAPTER 5
RESULTS AND DISCUSSION

The three sub-problems form the main areas investigated by this study. To answer the three sub-problems, Chapter 5 discusses results obtained through the utilisation of four data collection techniques that are the pre- and post-Internet Explorer installation questionnaires, interviews with educators found using the computers and observations of computer use and focus group discussions concerning computer use by educators at Myeka High School. The results from the pre-Internet Explorer installation questionnaire are discussed in comparison with those from the post-Internet Explorer connection questionnaire. The results from the two questionnaires are supported by results from observations, interviews and focus group discussions as presented under the relevant sections. In order to test the hypothesis, the results will be discussed further to determine whether the use of computers by Myeka High School educators was accelerated by Internet Explorer introduction when supported by relevant training, the physical infrastructure and school management capacity.

5.1. Influence of computer introduction on adoption by Myeka High School educators

The manner in which computers were introduced to Myeka High School educators was assessed as a factor influencing the extent of their use. At Myeka High School, four educators across three focus groups mentioned that an NGO, a computer company and the Headmaster introduced the computers, and they (educators) were told that overseas companies donated the computers and that they would receive training on how to use them. Two educators said they heard from other educators that there were computers in one of the classrooms. From focus group discussions, a consensus was reached that computers were not formally introduced to the educators, nor was it explained by the Headmaster how the educators were expected to use them (Figure 5.1.). Contrary to Chetty's recommendations for the introduction of computers to educators in rural schools (see section 2.41.), Myeka High School educators were not prepared for the acceptance of computers and did not understand the role and value of computer use in their school.
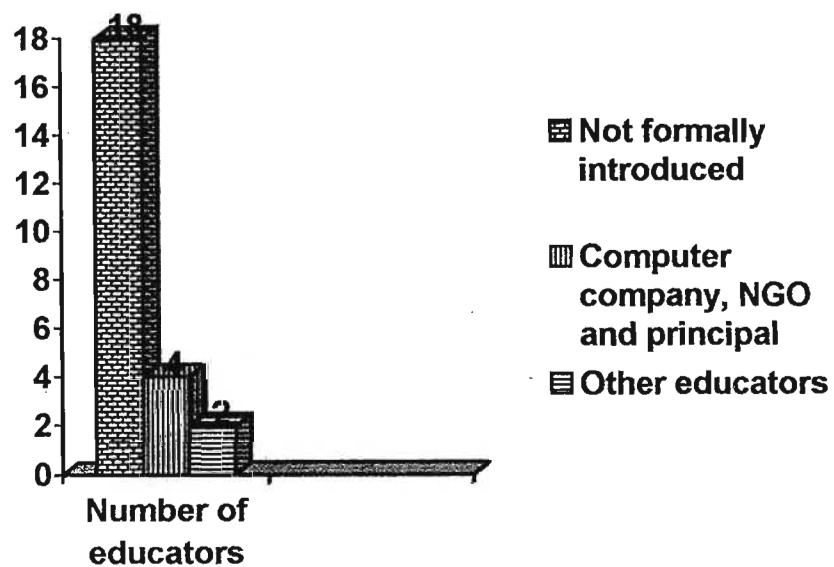
Figure 5.1: Myeka High School educators' perceptions of computer introduction to the school (n=24).

The lack of formal introduction of computers to Myeka High School educators meant that educators did not understand the educational, administration and management value and potential of the computers in their curricula, as suggested by Chetty (2000). Two educators mentioned that it was difficult for them (even after a short period of computer training) to familiarise themselves with using the computers, due to the lack of information and understanding of solar-powered computers and they did not know how they operated. These two educators also indicated that they did not know whether the computers were for computer literacy educators and their classes only, or for all educators in all modes of use. This could be counted as a factor that initially hindered computer use, as the educators did not know whether they could use them or not.

5.2. The influence of computer training on computer use

Following the introduction of computers, the training of educators to understand the application of computers to their tasks and educators' human capacity development would be the second logical step to encouraging and integrating computer use by educators in the learning environment (Francis, 1995; Osin, 1998; Alvarez *et al.*, 1998). Therefore, Myeka

High School educators' computer skill training level was investigated as a possible factor influencing the extent to which educators used computers (see sub-problem one). The Valley Trust NGO in KwaZulu-Natal designed and offered Microsoft (MS) Word and Excel training for 20 days in the computer room at Myeka High School a month after the provision of computers in 1998. Eleven interested Myeka High School educators attended this MS Word and Excel training in the school's computer room at allotted times, during their free periods. The training took the form of group instruction with the educators, as they were available.

The training included how to use MS Word and MS Excel spreadsheets for recording learners' marks and carrying out calculations. The results from the post-Internet Explorer questionnaire showed that a second 20-day MS Word and Excel training was offered at the school, a month after the three computers in the resource centre were connected to the Internet. Of the nine educators who attended the second training course, six had attended the first training course. This indicated that they were interested in acquiring computer skills. The other three educators felt that they had learnt sufficient and did not need further training. Three of the educators were attending their first computer-training course. These educators did not attend full day, but only during their free periods.

Four of the nine educators who attended the second MS Office training modules were selected to simultaneously attend an additional Internet Explorer training for subject searches, held in the schools' resource centre by the same NGO. Four educators were selected by the Head of Department on the basis of interest they had shown in attending computer training sessions and also on the subjects they taught: Accounting, Business Economics, Computer Literacy and Mathematics. These four educators later voluntarily attended a one-day demonstration on how to use the Learning Channel offered by personnel from the Learning Channel Company. The Head of Department, Mr Ndlovu, stated that due to commitments, limited time and number of computers, educators could not attend the full computer training designed by Valley Trust. As a result, educators' computer training attendance ranged from one to three days, one week, to two weeks, depending on each educator's personal interest and the availability of time and free computers.

Some educators did not attend the computer training sessions at all. In terms of the computer literacy level of all educators, the study found that at Myeka High School 17 (71%) of the educators considered themselves computer literate and 7(29%) declared themselves computer illiterate (Table 5.1). Myeka High School educators indicated their computer literacy level in the pre-Internet Explorer questionnaire in terms of type of computer training received, duration and extent of use. Myeka High Schools educators' computer literacy level was also assessed through computer use observations by the researcher and work they produced after computer use, found in Appendices K, L, M, N and O. The training of Myeka High School educators in computer use was essential as they needed to know the use of computers in supporting educators' tasks, as Francis (1995) emphasised (section 2.4.4). However, high-quality educator training for computer use should be conducted as an ongoing process, not only as a once-off approach (Guhlin, 1996; David, 1999; Garson, 1999 cited by NCREL, 2000).

Table 5.1: Myeka High School educators' computer literacy level (n=24)

Computer literacy	Training type received	Number of user educators
Computer literate	Non-formal NGO's training offered at the school	13
	Formal pre and in-service training from tertiary institution	2
	No training but do use computers	2
Computer illiterate	No training and no computer use	7

In summary, the results implied lack of formal introduction of computers to Myeka High School educators. Having heard that there were computers in Myeka High School, the Valley Trust offered two short training sessions on computer use to 13 interested educators. This led to an inquiry as to whether Myeka High School educators developed an interest in using the school computers.

5.3. Educators' interest in using the school computers

Myeka High School educators' interest in using the computers was assessed as a motivating factor influencing their computer use. During focus group discussions, educators were asked whether they were interested in using the school computers for their tasks after receiving training. Contrary to the findings by Summerly (1996, cited by Wetselaar, 1997, refer also to section 2.8.2), 18 (focus group attendants) Myeka High School educators across three focus groups indicated that they were interested in using the school computers and they all perceived computers as useful to them. However, they further mentioned that their interest was dampened by their limited opportunities for computer use and maintenance skills, lack of time to use computers and by the school's physical infrastructure (see later discussion).

5.4. Types of programs used before and after Internet Explorer access

The first sub-problem of this study set out to investigate the software types used by Myeka High School educators as a factor determining extent of computer use. Seventeen Myeka High School educators used a total of nine types of computer programs, regardless of their level of computer training. These programs included MS Word, MS Excel, Learning Channel, GroupWise e-mail, Internet Explorer, MS PowerPoint, WordPad, Media Player and Weather Station for various educating tasks (see later discussion). The Internet Explorer, MS PowerPoint, WordPad, Media Player and Weather Station programs were used only after the Internet Explorer had been installed. The extent to which educators used these programs for various educators' tasks were classified into two categories: educating strategies (subject information searches, lesson preparation, assignments, class tests and examinations) and class/school administration (recording learners' progress, preparing learners' results, class register, class timetables, class duty lists and the school budget).

A large proportion of 22 (91%) educators indicated the use of a word-processing program (MS Word) for both educating strategies and class administration. These 22 educators reported the use of MS Word exceeded the number of users (17 educators) because five of the non-user educators indicated MS Word use for various educating tasks. The assumption

was that these educators knew the type of software that was used by others who did typing for them. The post-Internet access questionnaire results reflected a decrease in number of users by five educators in MS Word use (from 22 to 17) after access to the Internet Explorer. The five educators were computer non-user educators who had reported MS Word use on the pre-Internet access questionnaire, but did not do so on the post-Internet access questionnaire and after second training. Therefore, the decrease in number of MS Word users did not reflect decreases in the extent of computer use. This implied that the real number of MS Word users was 17, which meant no increase in MS Word use even after the second training session, as it seemed the additional five claimed users were "indirect" users, asking proficient educators to type for them (Figure 5.2).
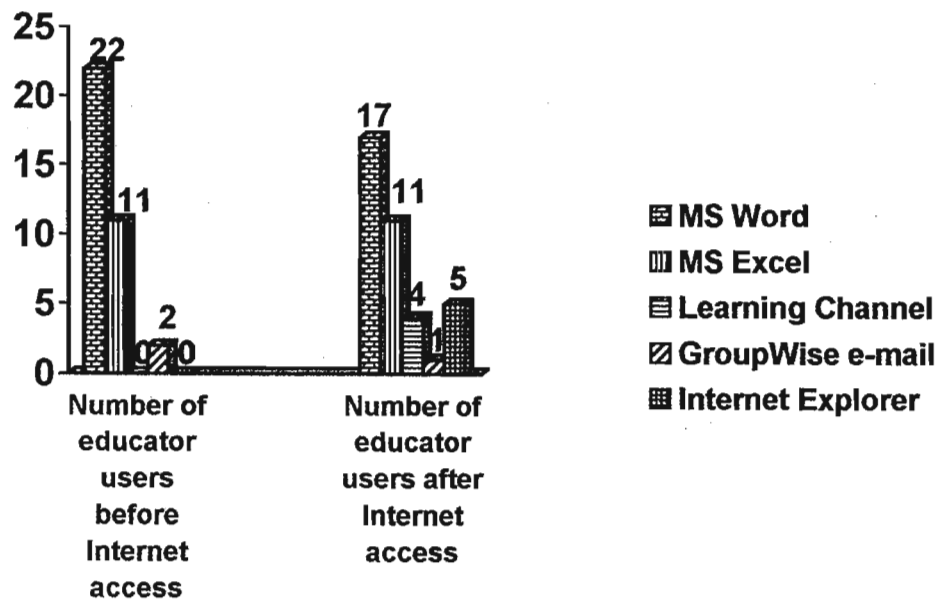
Figure 5.2: Types of computer programs used by Myeka High School educators before and after Internet access (n=24).

5.4.1. Microsoft Word use

MS Word was the most used program by Myeka High School educators 17 as shown in Figure 5.2. Only the secretary used GroupWise e-mail after Internet Explorer access to send messages for others. The installation of the Internet Explorer and its training received by four educators increased the number of computer programs used at Myeka High School.

Five members of the school staff (four educators and the secretary) used Internet Explorer. The availability of the Internet Explorer extended the use of the computers as its users had already mentioned the use of other programs, namely, MS Word, MS Excel, Learning Channel and GroupWise. One educator mentioned the additional use of MS PowerPoint, WordPad, Media Player and one Geography educator used Weather Station after the second training session and Internet Explorer installation.

For improved educating strategies and class administration, educators used Microsoft Word for various tasks, as illustrated in Table 5.2.

Table 5.2: Tasks carried out using MS Word before and after Internet access (n=24)

Activity	Number of user educators before Internet access	Number of user educators after Internet access	Increase in number of user educators
Produce test papers	20	21	1
Produce examination papers	17	18	1
Produce summaries of lessons	8	10	2
Produce worksheets	6	6	0
Produce class cleaning roster	5	6	1
Produce class register	6	7	1
Produce class timetable	6	7	1

Findings from the pre- and post-Internet access questionnaires on the greater use of computers for educators' improved educating strategies in class assessment tasks were supported by observational results of computer-generated test and examination papers (found in Appendices M and N). Two educators were found using computers for setting trial examination papers for five days in a month prior to the trial examination date. This supports the finding by Cedras and Selikow (1998 referred to in section 2.7) that educators used computers mainly for typing examination scripts.

In summary, the results of the types of programs used by the Myeka High School educators showed that computer use was mostly confined to the software in which educators received training. International experience shows that when educators were inadequately trained they lacked confidence to move beyond word processing to a more problem-orientated approach (Howell and Lundall, 2000).

5.4.2. Microsoft Excel use

Myeka High School educators received training in record keeping and calculations using MS Excel spreadsheets. As a result, 11 Myeka High School educators used MS Excel spreadsheets for both class and school management tasks (Table 5.3). Literature reflected the range of computerised management and administrative tasks for which educators could use computers (Table 2.3). This implied that Myeka High School educators' use of computers in spreadsheet applications was consistent with international findings. Educators used MS Excel to enhance their class administration tasks, which included recording learners' marks and class averages, as indicated in Table 5.3. For school management tasks three educators used the MS Excel spreadsheet for recording sports financial statements, while one educator used MS Excel for recording field trip financial statements. There was no change in the number of MS Excel users after Internet Explorer access.

Table 5.3: Microsoft Excel use by Myeka High School educators before and after Internet access (n=24)

Activity	Number of user educators before Internet Explorer access	Number of user educators after Internet Explorer access	Increase in number of user educators
Record learners' marks	11	11	0
Calculate class average	9	9	0
Record school sports financial statement	3	3	0
Record school field trip financial statements	1	1	0

5.4.3. Learning Channel use

The Learning Channel is an online learning site for educators and learners in secondary schools. In 2000, at the inception of the present study, the Learning Channel was not functional at Myeka High School. Five educators used the Learning Channel after full satellite connectivity between the school and the Internet. This implied that access to Internet Explorer increased the number of programs used, as the Learning Channel is accessed via Internet Explorer application. The educational material produced by the Learning Channel in Johannesburg is stored on Myeka's server in the computer centre. This educational material is accessible on www.learn.co.za. A copy of a grade 12 mathematics summary page downloaded from this website at Myeka High School is found in Appendix P. Five educators used this educational material to enhance their educating strategies. Educators used the Learning Channel to get summaries of lessons and previous matriculation examination papers.

Myeka High School's server also supports a CD Writer, by which the database of educational material is written onto CD-ROMs. One of the aims of introducing computers in schools is to use them as tools to teach subject matter (Howell and Lundall, 2000). There is a potential for this aim to be achieved at Myeka High School, as two educators further used the Learning Channel to conduct Biology, Business Economics and Physical Science lessons in classrooms where there was a computer and a television set. The lesson is conducted by running a relevant subject CD (downloaded from the Learning Channel website) on a computer linked to a 74-cm colour television set and loading it onto the screen, where learners could see lesson summaries and diagrams and participate interactively.

The Learning Channel provides valuable educational resource material, covering a variety of secondary school subjects such as Accounting, Biology, Computer Science, Economics, Geography, Mathematics and Physical Science. This channel could be very useful to educators as it consists of summaries, diagrams of lessons, diagrams for illustrating concepts, worksheets for drill and practice, assessment tests and examination papers that make educating easier. It also provides educators with other sources of information, which

could be used for further study (Lissoss, 2000). The school subjects that the Learning Channel was used for included Accounting, Business Economics, Computer Studies, Physical Science and Biology and Geography in Grades 11 and 12. One educator said she was willing to use the Learning Channel but unfortunately her subject, hotel keeping and catering, was not offered through the Learning Channel. She could have obtained the information from the other Internet Explorer information search engines, but she had little awareness because of lack of Internet Explorer training, and lacked the confidence to explore potential resources. This educator could have asked for advice about other information search engines from those who received Internet Explorer training. The potential for increased computer use through Internet Explorer introduction was not realised.

The use of the Learning Channel apparently contributed towards a good matriculation pass rate for 2001 in the subjects in which it was used. In 2001 there was 100% matriculation pass rate in Accounting, 97% in Business Economics, 76% in Geography, 58% in Physical Science, with a poorer percentage (13%) in Biology, for which the Learning Channel was used (see Appendix O for Myeka High School 2001 matriculation results analysis). This finding indicated that computer use for lesson summaries and for conducting lessons may have had a positive impact on matriculation pass rates. The overall matriculation pass rate at Myeka High School in 2001 was 75%, a 20% increase after the acquisition and use of computers at the school in 1998.

5.4.4. Communication and information programs use

In 2000, at the inception of the present study, there was no Internet access at Myeka High School. Two educators mentioned in the pre-Internet access questionnaire that they needed the Internet Explorer as additional software to support their tasks. This indicated some knowledge of computer potential in enhancing educators' tasks. After the installation of Internet Explorer, four educators received training in Internet Explorer use for subject information retrieval. These four educators and the secretary made use of the Internet Explorer for two main tasks, illustrated in Table 5.4.

One educator stressed that they needed extensive training in the utilisation of Internet Explorer to maximise its use in enhancing their tasks. Blignaut (1998) asserts that Internet access makes it possible for educators to access local and overseas databases to obtain specific reference information, as well as improving their written communication skills.

Table 5.4: Communication and information programs used by educators in Myeka High School (n=24)

GroupWise e-mail	Number of user educator
Order newspaper copies from the industry ('The Mercury newspaper")	1
Communicate with business associates and friends	1*
Internet Explorer	**Number of user educators**
Subject information searching	4**
Communicate with other educators abroad	1

*Uses home computer. **Includes the Secretary.

Two educators claimed the use of enhanced communication skills through the use of GroupWise e-mail for varying tasks (Table 5.4). The use of the Internet Explorer and GroupWise e-mail (through a school's communal e-mail address) by these educators indicated a higher level and greater extent of computer use. To support his educating strategy, the English educator at Myeka used e-mail to request copies of newspapers from the industry for additional classroom English language development. No educators indicated the use of school e-mail after Internet Explorer access. The secretary alone was using it to send messages for the educators, as there was one communal e-mail address. None of the Internet Explorer users reported the use of personal e-mail addresses such as yahoo or hotmail. This further implied lack of confidence in exploring other Internet potential uses in other activities and interest in using computers when there was someone to assist.

5.4.5. Classification of computer use at Myeka High School

The types of programs used and tasks carried out at Myeka High School are classified according to the six modes of computer use for the educating-learning tasks, as well as for administrative and management tasks, following King (1999 refer to section 2.5). As the aim of introducing computers at schools is to use them as tools to teach subject matter, to promote problem solving and as a management and administrative tool, the results from the study at Myeka High School are illustrated in Table 5.5.

Table 5.5: Classification of computer use according to six modes of computer use

Computer Application (Educating)	Program used by Myeka High School educators	Activity program that educators used for	User educator	
			Number	Percentage
Lesson preparation	MS Word	Type summaries of lessons	11	45
	Internet Explorer	Search subject information	5	20
	Learning Channel	Obtain summaries of lessons	1*	4
	GroupWise (e-mail)	Request newspaper copies	1	4
Lesson presentation	Learning Channel	Present lessons using CD and TV set	2*	8
	MS PowerPoint	Present lessons	1	4
Computer Application (class administration)	MS Word	Type test papers	21	87
		Type examination papers	18	75
		Type class timetable and register	7	29
	MS Excel	Record learners' marks	11	45
		Calculate class average	9	37
Computer application (School management)	MS Excel	Record sports financial statements	3	12
		Record field trips financial statements	1	4
	MS Word	Type parents' meeting invitation letters	1	4

* These educators taught multiple subjects

Myeka High School educators used computers to a greater extent for management and administrative tasks (class assessment) than for subject information searching, lesson

preparation and/or presentation. This indicated that the aim of introducing computers to schools for efficiency in administrative tasks was the more likely to be achieved at Myeka High School than for subject information searching. The use of MS Word mostly for administrative tasks was already expected, based on the findings of Cedras and Selikow (1998), who found that educators used a word processing program mostly for administrative purposes, regardless of other potential uses for other tasks (section 2.7). It can be summarised that in terms of skills level acquired, educators' computer use did mainly increase at Myeka High School after the second training session. However, the extent of computer use in terms of programs appeared to be limited mostly to MS Word (a reflection of the content of training received) (See tables 5.2 and 5.3). The wider use of computers in terms of the number of programs (total of nine programs) indicated an increasing extent of computer use in the school, though with few users of each program/mode. The extent of MS Word use was reflected by what educators produced after using the computers. Educators generated answer sheets, learners marks' records, tests and examination papers and learners' results sheets of good calibre (found in Appendices K, L, M, N, and O).

5.5. Time spent by educators on school computer use

The amount of time spent on computers by Myeka High School educators was assessed, to determine the extent to which those programs were being used. The time spent on computer use by Myeka High School educators, and factors that limited time for computer use, are discussed in the following sub-section. The time in hours spent on using school computers per week by Myeka High School educators was investigated as an indication of the extent to which computers were being used. Of the 17 educators using school computers, 11 indicated the number of hours they spent on computers per week and the other six educators did not specify it. There was a great variation in terms of hours spent on computer use by educators, ranging from 1-20 hours per week before and after Internet access (Figure 5.3).
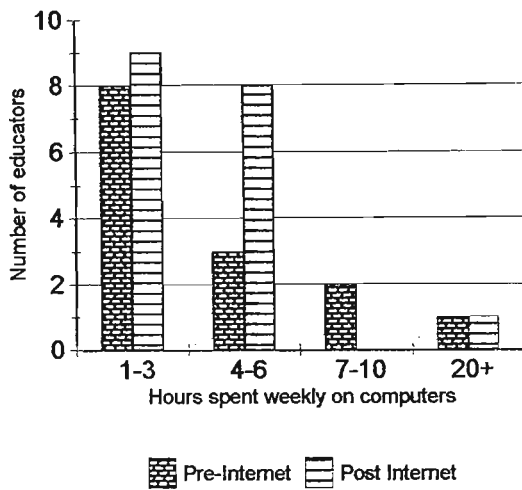
Figure 5.3: Average hours spent on computer use by educators per week before and after Internet access (n=14).

The results presented in Figure 5.3 show that most educators (eight and nine) spent one to three hours per week working on computers before and after Internet Explorer access. This length of time is regarded as very short as the 20 computers at school can run on solar energy for three to seven hours per day (Kempenaar and Wiersma, 2000). Contrary to what was expected, none of the educators with Internet browsing skills indicated increases in time spent on computer use resulting from additional use of the Internet Explorer program. It seems that they spent less time after Internet Explorer connection. This could perhaps be caused by limited free time for computer use at school, as was found through informal interviews. Perhaps the small numbers of educators involved in the study did not provide evidence of minor trends.

Besag and Levine (1994) felt that with the advent of computers in education, educators could search for information, but to accomplish this educators need time to use information searching software programs. Results of a study by Hawkridge *et al.* (1990) indicated that, in developing countries, pressure on educators to finish the syllabus is immense. Pupils and parents reject any attempt by educators to spend time on what is perceived as being peripheral to the syllabus.

A factor which limited educators' use of school computers was the tight school timetable, which also hindered other educators from attending the training sessions, even when offered at the school, and the remoteness of the school (Figure 5.4). This finding is supported by results from a study by Chaiklain (1994), who found it difficult for educators to find time to use computers at school because there are usually so many other demands on their time. Myeka High School educators mentioned that poor transport limited their time to use the school computers to a great extent, because the school is in a remote area and the last bus transporting them out of the community back to their homes passed the school at three o'clock, soon after the close of school each day. This implied that Myeka High School did not receive all of the benefits from the vast amount of information on the Internet which could support their tasks, such as lesson preparation. However, limited benefits were obtained for example improved matriculation results.
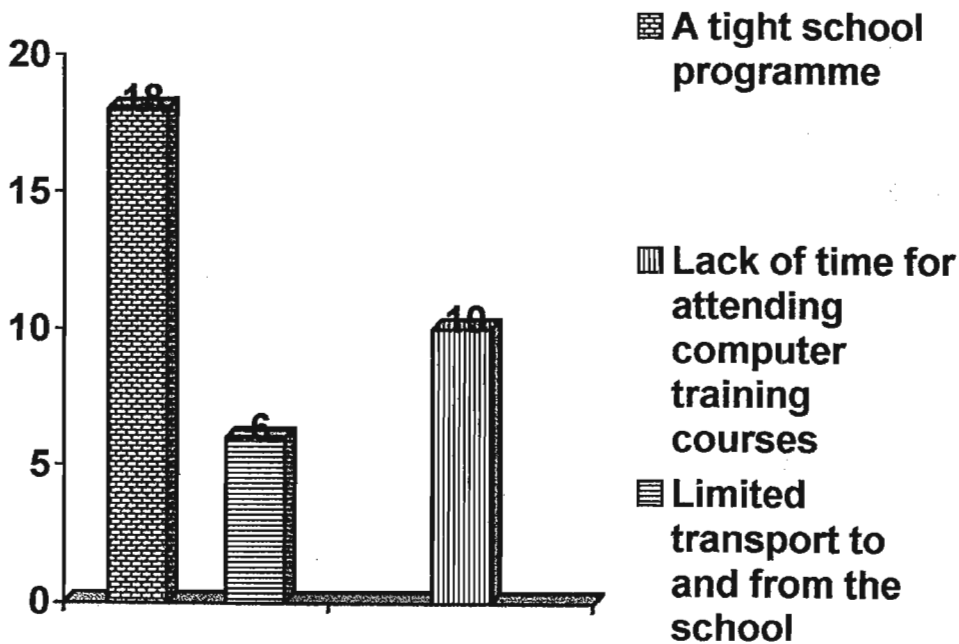
Figure 5.4: Factors hindering computer use by Myeka High School educators (n=18).

5.6. Does Internet Explorer access increase the extent of computer use by Myeka High School educators?

In answering the second sub-problem of the present study, this sub-section will discuss briefly whether or not Internet access increased the extent of the use of computer by Myeka High School staff. The results discussed in the previous sub-sections on the number of computers, types of programs used and time spent on using computers indicated no significant increase of computer use after Internet access and training. The additional five programs used by one educator after Internet access could be associated with familiarity and confidence in computer use gained through exposure to the computers. The number of hours spent by the four educators who used the Internet Explorer remained the same as before its access. Internet Explorer access and its training had little influence on the extent of computer use by Myeka High School educators because only a few (four) of the educators received training in how to use this program, mostly due to some constraining factors relating to time and the physical infrastructure of the school, which is supported by Potomac, 1999 (section 2.8.3). These factors are discussed in the following sub-section.

5.7. Key factors influencing computer use by educators

In this study, educators' perceptions regarding factors affecting computer use were classified as motivating and discouraging factors, respectively. These factors were established through both pre- and post-Internet access questionnaires, but a clear picture of their influence on computer use was established through focus group discussions and observations by the researcher in the computer room. Under motivating factors, in the pre-Internet access questionnaire, educators were asked to indicate the achievements that the computers had brought to their school and the perceived improvements in educators' tasks through computer use.

In the post-Internet access questionnaire, educators were asked to indicate the benefits resulting from computer use. The motivating factors were regarded as factors positively attributed to the use of computers by educators. Myeka High School educators were asked

in both questionnaires to indicate factors discouraging them from using computers. Howell and Lundall (2000) also considered the need for this (refer to section 2.8).

5.7.1. Educators' perceived achievements with the aid of computers

Educators at Myeka High School chose three types of achievement, which they perceived the computers had brought to their school. These were teacher training at the school, typing examinations and generating summaries of notes (Figure 5.5). The most important advantage that computer use had brought to the school for educators was its capacity as an administrative tool, especially for typing examination papers, as 15 of 17 user educators reported. Typing examinations at the school was perceived to be the most important benefit brought by the computers to the school, since this was previously done at the KZNDoE circuit office, which was very far away from Myeka High School. This supported the findings by Howell and Lundall (2000), that in South Africa, schools that have computers reported improved administrative efficiency in preparing examination papers, with word processing as the most important use of computers by educators (section 2.5).
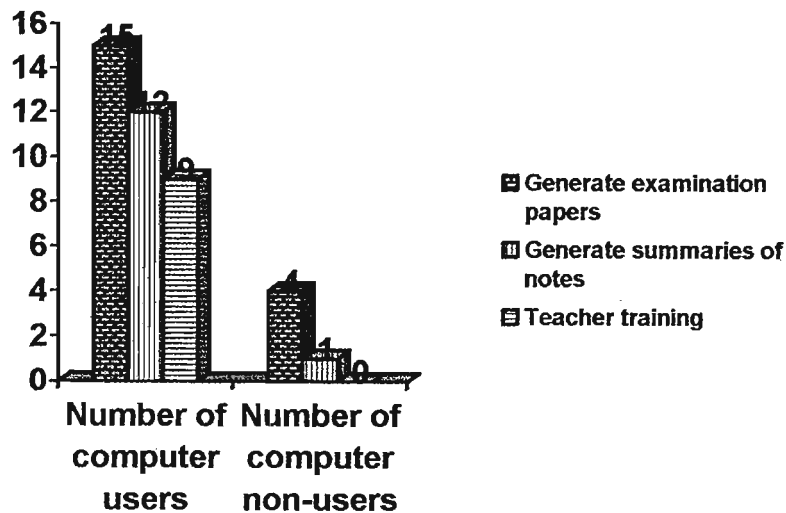
Figure 5.5: Educators' perceived achievements with the aid of computers (n=24).

As the school computers were used to train educators in computer skills, nine of the users perceived this as an achievement, as 13 educators became computer literate after attending the training sessions held at the school. Training of educators in computer use at school

could be regarded an important achievement resulting from computer availability at the school, as these educators were not equipped with computer use skills during their pre-service training. Access to computer training helped educators to use the computers, as has been indicated in previous sections. One educator felt that the availability of computers drew more learners to the school. However computer non-users reported that computer training was not achieved with the aid of computers in the school. The assumption was that maybe these educators had expectations of extensive computer training at the school, but the school management did not organise ongoing computer training with any potential organisation, after the Valley Trust had completed its computer training sessions.

5.7.2. Educators' perceived improvement in educating skills through computer use

After Internet access, educators were asked to state perceived benefits from computer use. The results of this study indicated that nine educators did not perceive any improvement in their tasks, while 15 did perceive improvement as a result of computer use. The educators who used the school computers perceived the improvements in their tasks. After perceived improvements in the educators' tasks, in the post-Internet Explorer questionnaire educators were asked to indicate the benefits resulting from improved educators' tasks. Twenty-one indicated the benefits attained with their improved tasks. This number (21) exceeded the number of users who had perceived improvement in their tasks (15), because the educators gave more than one benefit which indicated the ability to identify a variety of benefits from each mode that a computer was used for. The ability to produce well-planned notes, worksheets, tests and examination papers was perceived by a higher number of users (9) as improving their tasks and benefits thereafter perceived by 13 educators, which reinforced the popularity of the word-processing program (Table 5.6). The material of high calibre resulting from these perceived improvement in educators tasks are attached as appendices K, L M, N and O. Previously hand written documents were produced.

Only three educators perceived the benefits of Internet access as enhancing communication with other colleagues abroad and broadening educators' scope of subject knowledge. This was contrary to what was expected. No educator mentioned the benefits derived from GroupWise e-mail use. From short informal interviews concerning the benefits of computer

use, most educators who were using computers reported how much easier it was to educate when learners received copies of lesson summaries. One educator felt that computer use in the school would enable learners to access the information through the Learning Channel and thereby supplement what the educator had taught in class.

Table 5.6: Improvements in educators' computer skills and benefits through computer use (n=24)

Perceived improvement in educators' tasks	Computer users number	Perceived benefits through improvement in educators' tasks	Computer users number
Ability to produce well-planned notes, worksheets, tests and examination papers	9	Typed documents make educating easier	13
		Computer-generated notes maximise time for educating	2
Ability to get subject references from the Learning Channel	1	Well-summarised subject information for learners	6
Can do administrative and managerial task more efficiently	2	Efficiency in administration and management tasks	4
Ability to browse the Internet Explorer for subject information	3	Broadened educators' scope of subject knowledge	3
		Enhanced communication with international colleagues through the Internet Explorer	3
Can keep students' record reliably	1	Can retrieve previously learnt material	2

Note - more than one response permitted. Not all perceived improvements in educators' tasks necessarily resulted in the expected benefits.

One educator perceived the efficiency of computer use in school management as improving his tasks. Such school management work included typing invitation letters to the school governing body and parent meetings (found in Appendix R) and lists of learners and school budgets. Lesson preparation was found to be the most important advantage of computer use in Myeka High School, even by the non-user group. The perceived achievements that

computer availability brought to Myeka High School, realisation of improvement in educators' computer skills level which led to benefits, may have motivated the 17 educators to use the computers. In focus group discussions educators suggested that changes be made to ensure more computer use which also indicated interest in computer use. However, there were factors that negatively influenced computer use.

5.7.3. The influence of lack of technical support on computer use by educators

The extent of computer use by educators in the Myeka High School was limited by lack of immediate technical support. When educators were using the computers they encountered difficulties, both with the software and the hardware, where they needed immediate technical support. From observation, one educator's interest was dampened by disruptions caused by solar power failure, which caused her to lose her document before saving it. Another hardware-related problem was that her floppy disk got stuck in the disk drive and she could not extract it. She immediately went to the classroom to write notes on the chalkboard for the following class lesson (Observational findings are found in Appendix S).

Osin (1998) documents that the use of computers in schools requires different levels of technical support: the first level of such support needs to be based within the school. This requires that one educator be made responsible for the computer system, to solve minor technical problems, be in charge of the system disk backup, provide advice to educators less acquainted with the system and request maintenance when a technician is needed. Further technical support via help facilities, contracts with local technicians and companies are also necessary, which includes provision of equipment to schools, maintenance and repair (on a technical and advisory level) and involvement in extending computer networks (section 2.4.5).

On the question of problems concerning keeping computers in good condition and good working order, educators across the three groups perceived dust to be the main problem causing computer breakdowns. Furthermore, 11 educators reported lack of immediate technical support personnel for daily computer checkups, while seven educators reported lack of air-conditioners as causes of the daily computer breakdowns which further

minimised computer use (Figure 5.6). All educators said they stopped working on computers for a while when they encountered computer breakdowns and waited for solar engineers who sometimes took two weeks to respond to their reported problems. This meant that computers were sometimes not used for up to two weeks after breakdowns.

An additional problem was specifically related to computers being supplied with electricity power by a solar system. No educators were trained to maintain the solar power system. Educators across the three focus groups agreed that computers did not work when the weather was overcast and for the computer users this unreliability was the main cause of their reverting to traditional ways of educating, such as writing notes on the chalkboard instead of typing them out on the computer. This is supported by MacKenzie (1998 cited in NCREL, 2000) who found that educators revert to their traditional ways of educating when the technology at school is not easily accessed and if the problems they encounter cannot be solved quickly and efficiently (section 2.4.5.).
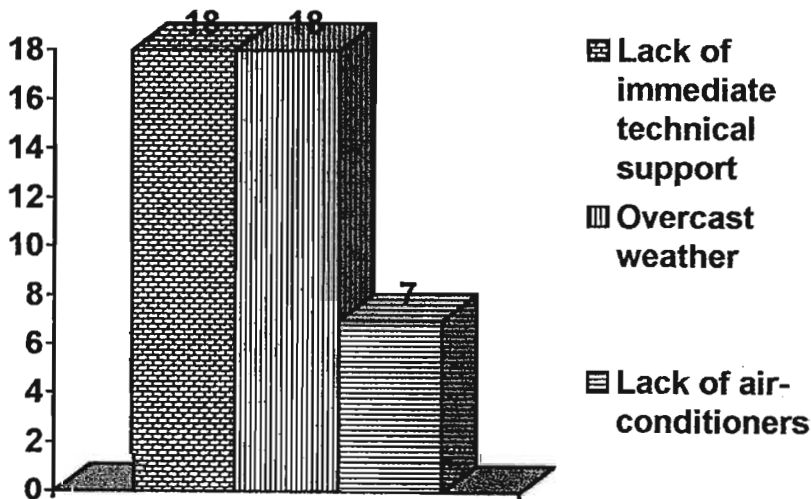
Figure 5.6: Technical factors discouraging computer use by Myeka High School educators (n=18).

One educator of the computer non-user group suggested that the KZNDoE should employ a technician to be stationed at the school. The whole group concurred with this suggestion. The computer user group suggested the training of one educator on the technical aspects specifically for the maintenance of the solar power source. This supports Osin (1998), who

outlined the need for technical support when computers are in place (section 2.4.5). The educators' suggestion of the provision of technical support personnel indicated the need to maintain solar-powered computers for future use. However, for Myeka High School, the need for a technician is greater because the technician should be knowledgeable about both computing and the technical aspects of solar powered systems.

5.7.4. The influence of computer maintenance costs on computer use

The Headmaster at Myeka High School mentioned that a large amount of school money was spent on buying ink cartridges and paper for printing and photocopying. All of these materials were found to be very expensive for the school. The most important facilities that needed ink were printers, and paper for photocopying, stated the Headmaster. Over a five-month period (January to May 2001), the school had consumed R2000 worth of ink cartridges and paper. This was perceived to be very costly as the KZNDoE did not provide funds for computer maintenance and consumables. School fees were only R100 per learner per year. This generated inadequate funds to finance the computer facilities. As the school was extending classrooms so as to have more classrooms to accommodate computer studies' learners, the amount of money spent on computer maintenance delayed the building extension process.

One disadvantage of the solar system is that batteries must be carefully maintained (Hankins, 1995). Sponsors had been responsible for the maintenance of the computer hardware and the solar system, but they were no longer offering this service. The Headmaster emphasised that the sponsors left them (school staff) at a teething stage, where about 80% of the computers were not working properly. The Headmaster mentioned that they were very grateful for the sponsors' assistance. However, he constructively criticised their assistance in that the school staff did not have control or participation in what the sponsors were doing to gain understanding of how to maintain and operate a solar system efficiently. In concluding the interview, he emphasized that it would have been better if the sponsors worked with them for capacity building at the school. It was also not clear who was responsible for computer maintenance at the time of the interview. This was also mentioned by Kempenaar and Wiersma (2000), in that inefficiency of the solar system in

powering computers was due to lack of clarity on who was actually responsible for the installation in terms of its optimisation, maintenance and upgrading. Concerning the influence of computer maintenance cost on use, it was observed that when the school was running short of money to buy ink cartridges and paper, computer use for lesson preparation decreased.

5.7.5. The influence of physical infrastructure on computer use

Myeka High School has access to road and transport systems, electricity, buildings, telecommunication systems and technological hardware comparable with the physical infrastructure required for computer use, as outlined by Chetty (2000) and Howell and Lundall (2000) (refer to Table 2.2). However, physical infrastructure at Myeka High School appeared to be unreliable and reduced the use of computers by the educators. From the findings, illustrated in Table 5.7, it can be seen that the main discouraging factor to computer use, as perceived by most educators, was repeated power failure or the threat of power failure while using a computer. From informal discussions with educators it was discovered that educators could not use all 20 computers together with a photocopier, because the power cut out. Therefore they could not use school computers if there was someone using a photocopier (this is supported by what was observed on a busy day. See appendix Q).

The evaluative study on what could be done to improve the efficiency of the Photovoltaic/LPGas system at Myeka, found that the Toshiba 17.10 photocopier at Myeka used excessive power. Therefore, when this photocopier was in use, there was not enough power left to use the computers. This photocopier also had surge wattage of 1500 units and this is the one of the reasons why the power system ran down frequently, as it was not designed for such large loads. Power failure also caused disruptions while educators were working on computers. Power failure during computer use by educators was considered as a waste of time, as the educators had to retype what they lost which further limited their interest in using the computers. Poor power supply problems limited Internet access.

One Internet user educator suggested that browsing for subject information on the Internet required more time and more power, which the solar system at the school was not designed to deliver. One educator, whose opinion was supported by the entire group, mentioned that some educators who were more skilled in terms of computer use, and also in charge of the computer centre, tended to treat computers as their personal possessions and did not allow the inadequately trained educators to use the computers for fear that they would break them. This supports Anon (1999), who found that some educators mentioned that staff who have authority over the computer laboratory treat it as private property and were unwilling to share (section 2.8.1). As a result, the educators who were incompetent at using computers ceased using them and remained incompetent.

Another factor hindering computer use was that computers often needed to be repaired, hence reducing the number of available resources. Kempenaar and Wiersma (2000) found that the computers at Myeka did not have a surge eliminator for protecting them when the power suddenly switched on/off. This caused computer breakdown at the school. The use of a photocopier commonly caused power failure. These constraints were classified into three categories (Table 5.7).

Table 5.7: Constraints to the use of school computers before and after Internet access (n=24)

Constraint categories	Constraint	Number of educator respondents before Internet Explorer access	Number of educator respondents after Internet Explorer access
Physical infrastructure	Poor power supply	9	12
	Few computers (limited access)	4	5
Educators' human capacities	Limited time	2	7
	Inadequate skills	1	5

Kempenaar and Wiersma (2000) found that the solar system at Myeka did not function adequately to supply sufficient power to the 20 computers and the photocopier. Therefore

this could be a major factor determining whether computers could be used or not. The poor road access and limited transport system, and Myeka's remoteness, also negatively influenced computer use by educators. The results showed that all educators across the three groups perceived limited transport as a factor that minimised computer use at the school, or after school, to prepare lessons for the following day.

The results concerning the constraints to greater computer use by educators (Table 5.7) reinforced the idea that the provision of reliable and adequate physical infrastructure in terms of electricity and computer hardware, as well as human capacity improvement in terms of educator computer skills training, both literacy and technical, are essential for the effective use of computers in schools. From focus group discussions, unreliable power supply was mentioned as the main disadvantage of solar-powered computer use in a rural school. These results implied that at Myeka High School a more powerful/reliable power supply was needed for educators to use the computers and to realise the improvements and benefits from computer use. Eleven computer user educators suggested that the school timetable be shortened so as to accommodate computer use hours, which indicated interest in using computers in the future. Two of the non-user group, respectively suggested that each school department should have its own computers and that 30 minutes be left after school so that the more skilled in computer use could teach the inadequately trained educators the basics of computer use.
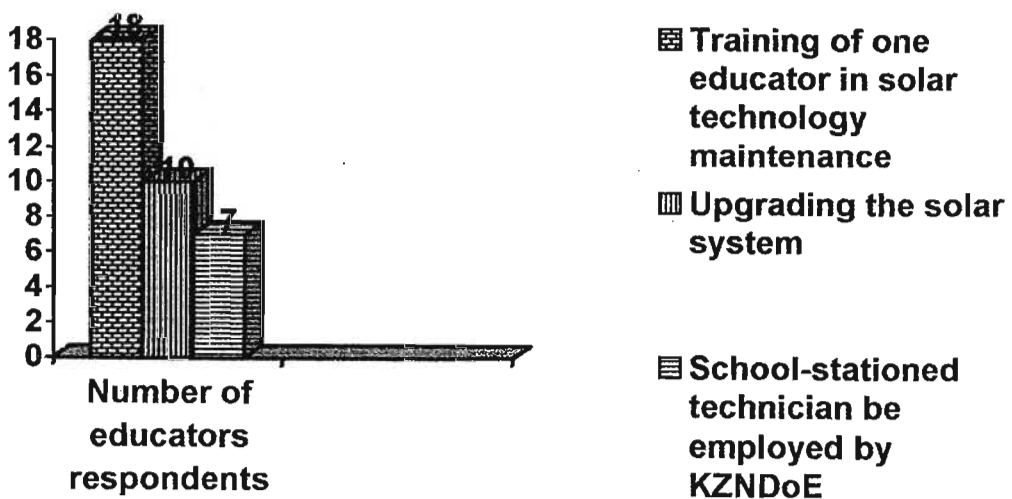
Figure 5.7: Myeka High School educators' suggestions for sustainable use of computers (n =18).

The present study found through focus group discussions that all participating educators (18) across the three groups suggested that training in the technical aspects of the solar system should be done on-site, to ensure that at least one educator understands the operation of the system well. These suggestions implied potential interest in using the solar-powered computers. However, contrary to what was expected, no educators suggested power management as the use of unreliable power at the school appeared to be a major factor hindering computer use.

5.8. Summary

This chapter has analysed and interpreted results as reported in the questionnaires and through informal interviews, observations and focus group discussions. What was found corresponded to findings in the literature. The results were discussed based on the statement of the problem and reflect issues pertaining to the findings for the three sub-problems.

- The extent of computer use by Myeka High School educators in terms of number of programs and time spent using computers.
- Assessing whether Internet access increased Myeka High School educators' extent of computer use for their tasks and,
- The factors motivating and discouraging educators to use computers at the school.

The review of literature indicates that it is easy to put computers into schools, but the extent and frequency of their use is questionable. The following is necessary for development of computer use in South African schools: reliable roads and transport, electricity, computer hardware and software and educators skilled in computers and maintenance backup. There is an assumption by researchers in computer use in schools that, by developing skills and knowledge concerning computer use, educators will inevitably use computers in enhancing their educating tasks. The present study found that there were factors motivating educators to use, and constraining them from using, computers at the school. The following chapter presents the summary of these results, researchers' conclusions and recommendations based on the conclusions of the study. It also presents a summary of the results of the study, and the study's recommendations.

CHAPTER 6
SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

Given the lack of supportive environment for the proper operation of computers and low levels of computer literacy among educators in rural schools, the purpose of this study was to investigate the extent to which educators at Myeka High School used solar-powered computers to enhance their tasks and also to establish factors motivating and discouraging educators to use computers.

The study was conducted at Myeka High School. This rural school is characterised by its remoteness, lack of grid electricity, lack of telephones, unreliable public transport and poorly maintained dirt roads, which are impassable when wet. Through private funding, this school was provided with 20 solar-powered computers in 1998. The school had 24 educators: 22 blacks and two Indians. Fourteen were females and 10 males. These educators were responsible for educating 845 learners. There was a secretary responsible for the school administration. Twenty-one educators commuted daily to school, using unreliable public transport, with only two educators using their own transport. There is one educator from the local community. Two black educators have diplomas in computer training. The Valley Trust offered computer training sessions for educators, before and after Internet Explorer installation. The Valley Trust designed and offered a 20-day computer training sessions, before and after Internet Explorer installation. However, educators at this school attended these computer training sessions only at convenient allotted times. The computer training sessions were not compulsory for all the educators.

Quantitative data were collected from the educators through survey questionnaires distributed to educators after they had received training in computer use skills and after Internet access. Qualitative data were collected through observations of computer use by educators, short informal interviews with educators found using the computers, an interview with the school Headmaster on the effect of computer maintenance costs on their use and focus group discussions with the educators about computer use at the school.

Data analysis relating to the introduction of computers to the educators established that the solar-powered computers were not formally introduced to Myeka High School educators but educators were expected to use them. This meant that the educators did not receive an understanding of the educational, administration, management value and the potential of computers in their curricula, as suggested in the literature. Having heard that there were computers at Myeka High School, a local NGO, Valley Trust, designed and offered a 20-day computer-training course to the educators before and after Internet access. Data analysis relating to the first sub-problem of this study established that the computer training course was limited to two applications: MS Word, MS Excel and Internet Explorer. Only 13 interested educators attended the training, as it was not compulsory. Four educators attended the Internet Explorer training on subject information searching and a demonstration on the use of the Learning Channel to receive lesson summaries and present lessons.

Seventeen computer literate educators made use of the programs in which they received training. They used MS Word more frequently than MS Excel and the Learning Channel. The least used programs were Internet Explorer and GroupWise e-mail. The educators spent, on average one to three hours per week using the computers for the enhancement of their tasks.

The second sub-problem investigated whether or not Internet access and training increased the extent of computer use by educators. Contrary to what was expected, there was no increase in terms of time spent on computer use and the number of educators who used the computers after Internet access and training. The limited number of computers (three) connected to the Internet and the existence of only four educators with Internet use skills limited increased computer use after the introduction of Internet Explorer. A tight school programme, unreliable power supply and insufficient transport to and from the school contributed to the limited extent of educators' computer use.

The third sub-problem investigated the motivating and discouraging factors to computer use by educators. The computers' capacity to be used for typing examination papers and summaries of notes at the school, improvements in educators' computer skill levels and

benefits accrued thereafter, motivated educators to use computers. Lack of computer maintenance skills and lack of immediate technical support; lack of time to use computers because of the remoteness of the school and the inadequate transport for educators commuting to school; and the unreliable solar system for power supply, reduced Myeka High School educators' interest in using the computers. In addition, the high cost incurred by computer maintenance hindered the use of computers when the school had run short of funds.

6.1. Conclusions

The hypothesis for this study, which stated that the use of computers by Myeka High School educators is accelerated by Internet access when supported by relevant training, the physical infrastructure and school management capacity, was rejected. The extent of computer use in terms of number of computer users, software types and time spent using computers did not accelerate as a result of Internet access and training.

This study concluded that access to computer training by educators had a positive influence on computer use, as the educators initially made use of the computers after the brief training held at the school. It is apparent that training is essential for encouraging educators to use computers. One to three hours spent on computer use by 11 educators was considerably too little, as the 20 computers could run on solar energy for three to seven hours per day. The study concluded that the educators needed more time to use computers for enhancement of their educating tasks. This was exacerbated by the limited availability of transport which meant that the educators could not put in additional computer practice after school. There was no increase in the extent of computer use once the Internet was available. Internet Explorer was expected to be an additional program to be used.

The study concluded that the poor physical infrastructure had more influence on computer use after Internet access, compared to the period before Internet access. The more computer programs were used, the more the solar system became inefficient in providing sufficient power to the computers. This implied that adding more programs for

use by educators required more optimisation and upgrading of the solar systems to supply sufficient power to the computers. In addition, the more computer programs that educators were expected to use, the more time was needed for educators to do so. Yet it was difficult for educators to create more time for computer use due to limited transport in the area, and tight inflexible school programme.

The factors that constrained computer use by the educators outweighed the motivating factors, as the constraining factors were more related to the school's physical infrastructure, which was beyond the control of the educators. Educators could not make use of the computers if the following happened: weather was overcast, computers were broken down, power went off, school ran short of printing paper and ink, school day closed and bus arrived, no matter how interested they were. This study concluded that computer use could only accelerate if attention is paid to factors like the school timetable, ongoing computer training and the physical infrastructure of the school.

6.2. Recommendations for improvement of computer use by educators

School management should facilitate computer training and make training compulsory for all educators. It should ensure that the educators with Internet skills train other educators so as to maximise the use of this program. However, maximum use will require that the solar systems be upgraded to provide sufficient power to three computers with Internet access.

Myeka High School has a wider responsibility for constant maintenance of the solar-powered computers, as the solar systems powering them requires careful maintenance. It is recommended that a technical management team be set up at the school for the maintenance of the solar power system.

The technical management team should be responsible for the following duties:
- Checking the number of computers that can be operated at one time and ensuring that those which are not in use are switched off to save power
- Ensure that computers are switched off after use to save power

- To ensure that the photocopier is not used together with the computers, since the photocopier consumes more power and is attached to the same power supply as the computers.

This information could assist the solar engineers responsible for the projects and also potential international solar engineers on the improvements needed for sustainable use of the computers. It is essential for the school to budget an annual amount of money needed for the system maintenance, as this could be used to ask for financial support from relevant stakeholders, since the KZNDoE does not cater for the maintenance of the school's technology. To extend computer use in terms of programs, it is recommended that the educators ask for AutoCAD program installation and training, as the school offers Technical Drawing and Industrial Arts subjects. In order to create more time for hands-on computer training, the school management team may have to make some adjustments to the school's day schedule and arrange for ongoing training.

One adjustment might be releasing learners one hour before the school ends at least once a month and use that time for educators' computer training, with one or two educators receiving technical training involving the solar power system (PV) working component. Arrangements should be made with the KZNDoE to provide computer literate personnel to offer ongoing training to educators once a week for 30 minutes after school, especially for those educators who did not attend computer-training sessions held at the school. This could be helpful for educators to continually upgrade their computer use skills. Access to technical training will equip those educators with skills necessary to maintain the equipment and be responsible for technical issues involved in keeping the system working. For solar power system maintenance training, arrangements need to be made with SES, which was responsible for installing the school's solar power system.

One of the ways in which the educators could apply the learnt computer use skills or extend computer use, in terms of programs, is in the area of registration and e-mail. Registration could be done on the Secretary's computer (in the Headmaster's office), where each educator would be required to type in 'present' next to their classes' names on MS Excel spreadsheet. To familiarise or upgrade their computer use skills, Myeka High School educators need to have e-mail addresses and each educator should be

required to check his/her e-mail every morning, or during free time. Therefore, once the staff spends a certain amount of time on computers doing compulsory registration and checking e-mail, it could be a short step to using them for other educating related tasks.

6.3. Public and private policy recommendations

It is recommended that any intervention aimed at promoting effective computer use by rural school educators should first develop human capacity more extensively (literacy and technically) and also improve the school's physical infrastructure in a way that will ensure the sustainable use of computers in schools. The first policy recommendation is that the NDoE should offer pre-service computer aided educating courses and then integrate educational software into the curriculum and design software to enhance the process of educating with computers.

Secondly, the NDoE needs to officially outsource school computer maintenance to non-profit private companies and NGOs, as they show outstanding interest in promoting computer use by educators in schools. Thirdly, the KNZDoE should, in partnership with the relevant service providers, such as the Department of Transport and Eskom, improve the physical infrastructure at Myeka High School in terms of accessible roads, reliable public transport and reliable power supply, in order to extend the use of computers by educators. The NGOs who give computer use training courses should extend sessions in terms of duration and numbers of programs (content). It is recommended that program installation be combined with the upgrading of the solar power system to ensure a sufficient supply of power to the computers.

6.4. Recommendations for improvement of this study

It is recommended that an introductory meeting be held with the school Headmaster and the educators to introduce the purpose of the study, the techniques to be used in collecting data and its predicted contribution to the education sector, in order to ensure good co-operation with all respondents. The researcher's failure to introduce the study to all respondents resulted in some of them lacking interest in completing the questionnaires

and in attending focus group discussions. In order to ensure the accuracy of questionnaires, pilot testing was done with a university student. Responses received indicated that pilot testing with a university student was not ideal, as it did not identify all the problems in the questionnaires. For example, question 15 (See Appendix B) should read, "If you do use the school computers, what computer programs do you use and what for?" As the question reads, "At school, what computer programs do you use and what for" it led the non-user educators to tick answers unnecessarily which eventually impacted on the results obtained. It is therefore recommended that questionnaires be tested for their accuracy with other educators and also with more than one person. The use of closed questions in the questionnaire tended to force educators towards unintended responses. Such questions should allow respondents to give reasons for the yes or no answers. The extent of each program used would have been better understood through asking the frequency of the use of the program, for example daily, weekly, and monthly.

The influence of computer training attendance on the extent of computer use would have been better understood through comparing the duration of training against computer use frequency. The extent of time spent on computers would also have been better understood if the duration of time was asked in relation to the program being used, for example how much time do you spend on using MS Word or Internet Explorer?

The monitoring sheet to record the programs used and hours spent by educators on using computers was not maintained. Therefore the researcher needed to have done the monitoring personally and this is regarded as one of the improvements needed in the future. The study could have involved a sample of trainers from the Valley Trust who were involved in designing and delivery of the computer training sessions to Myeka High School educators, in order to gain more information about how they tested the computer competency of Myeka High School educators.

6.5. Implications for further study

To further understand how the educators use the computers, interviewing learners is recommended, to gain an alternative perspective of computer use in subject classes generally. A comparative study between rural educator users of solar-powered and grid electric-powered computers is recommended so as to further understand factors constraining computer use and highlight the role of power supply in encouraging computer use. A comparative study between rural and urban educators, where the environment is convenient for the use of school computers in terms of access to a reliable power supply, where there are short distances to the school and adequate transport, is also recommended.

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APPENDIX A

List of organisations that contributed to solar technology development at Myeka High School.

LIST OF ORGANISATIONS THAT CONTRIBUTED TO SOLAR TECHNOLGY DEVELOPMENT AT MYEKA HIGH SCHOOL

1. Eskom- installed first pole-mounted solar panel in 1995.

2. DELL- donated five computers in 1998.

3. Uniliver- donated 15 computers in 1998.

4. Solar Energy Light Fund (SELF)- donated five printers, a scanner, Compact Disk Copier and a photocopier.

5. Shell Renewable Company- installed second pole-mounted solar panel in 1998.

6. Mangosuthu Technikon- installed Solar/LPGas Hybrid system later in 1998.

7. Solar Engineering Services and ML Sultan Technikon- provided technical support for the solar system and computers from 1998 to 2000.

8. The Valley Trust- offered computer training to educators in 1998, donated science laboratory equipment in 1999 and offered another computer training to educators in 2000.

9. University of Durban-Westville- donated solar-powered Weather Station in 2000.

10. Reach and Teach- offered introduction on computer use to educators in 2000.

11. InfoSat- installed Internet Explorer program to three computers in 2000.

12. Learning Channel Campus- provided Learning Channel education materials and a demonstration on their use in 2000.

APPENDIX B

Myeka High School educators' pre-Internet questionnaire.

A. DEMOGRAPHICS

1. Name ....

2. Gender...

3. Teaching experience (in years) (give answer below)

  total...

  in this school..

4. Place of origin of youth home (tick) Rural   Peri-urban   Urban

5. Do you live in Maphephetheni?   1 No   2 Yes

6. Subject(s) currently teaching...

....

7. Any computer training course(s) attended? (tick) 1 No   2 Yes

8. If yes, how long did it last? ....

9. Did you obtain any qualification(s) for that computer training course(s)? 1 No 2 Yes

10. If yes, what qualification(s)?...

....

11. Where did you obtain your teaching qualification? (Answer below)

11.1. Institution's name ....

B. COMPUTER USE

12. Do you use the school computers?   1 No   2 Yes

13. If no, are you computer literate?   1 No   2 Yes

14. Do you have access to computers elsewhere? 1 No   2 Yes

15. At school, what computer programs do you use and what for? (tick below)

     (i) Word Processing 1. Class register

              2. Class timetable

              3. Class cleaning roster

              4. Summary of lessons

              5. Test papers

              6. Examination papers

 Other (specify) ....

     (ii) Spreadsheet 1. Recording pupils' marks

(ii) Spreadsheet　　1. Recording pupils' marks

2. Calculating class average

3. Sports budget

4. Field trip budget

Other (specify)..

....

....

(v) GroupWise - E-mail (specify)...

....

....

16. What other computer programs do you use elsewhere and what for? (Be specific).

....

....

....

....

17. (i) How often do you use a computer per week? (give time in hours)...................................

(ii) How often do you use a computer at school per week? (give time in hours)...................

(iii) How often do you use a computer per elsewhere week(give time in hours).....................

18. How does computer use improve your teaching potential?

(i) for classroom teaching ....

....

....

(ii) for the community at large..

....

....

19. Do you use school computers for outside world communication?　　1 No　2 Yes

20. How does computer use enhance your learning experience? (choose answer below)

1. It has improve my administrative efficiency.

2. It has improve my communication skills.

3. It has made it possible for me to study independently.

4. It has made it possible for me to access local and overseas information.

....

....

C. IMPORTANCE OF COMPUTERS IN SCHOOL.

22. For teaching, what do you think is being achieved with the aid of computers in the school? (choose below) :-

    1. As a management tool

    2. Notes summary

    3. Teacher training

    4. Exam papers

    5. Other (specify) ....

....

23. For teaching, what do you think is not being achieved with the aid of computers in the school? (choose same options above)...

....

....

24. In general, what do you see as the importance of computers to the school? ....

....

....

....

25. Constraints to more use of computers. Be specific...

....

....

....

APPENDIX C

Myeka High School educators' post-Internet questionnaire.

Name...

A. COMPUTER TRAINING COURSE.

1. Did you attend any computer training course(s) since August 2000 (tick below)

1 No   2 Yes

2. How long did it last?...

3. Which program did you use at that computer training course(s)?.................................

....

4. Did you obtain any qualification for that computer training course(s)? 1 No   2 Yes

5. If yes, what qualification? (specify) ....

6. Did you receive any computer maintenance training?   1 No   2 Yes

B. SCHOOL COMPUTER USE.

1. Do you use the school computers?   1 No   2 Yes

2. How often do you use a school computer per week? (give time in hours).......................

3. At school, what computer programs do you use and what for? ....

....

....

....

4. Personally, what do you see as the most important benefits of school computer use to the educators? ....

....

....

....

5. What are the most important personal constraints to using school computers?.............

....

....

....

....

APPENDIX D

Myeka High School secretary's questionnaire

A. DEMOGRAPHICS

1. Name ....

2. Gender ....

3. Secretarial experience (in years) (give answer below)

      total ....

      in this school ....

4. Place of origin of youth home (tick)   Rural   Peri-urban   Urban

5. Do you live in Maphephetheni?   1 No   2 Yes

6. Administrative task(s) doing ....

....

7. Any computer training course(s) attended? (tick)   1 No   2 Yes

8. If yes, how long did it last? ....

9. Did you obtain any qualification(s) for that computer training course(s)? 1 No 2 Yes

10. If yes, what qualification(s)? ....

....

11. Where did you obtain your secretarial qualification? (Answer below)

1. Institution's name ....

B. COMPUTER USAGE

12. Do you use the school computers?   1 No   2 Yes

13. If no, are you computer literate?   1 No   2 Yes

14. Do you have access to computers elsewhere?   1 No   2 Yes

15. At school, what computer programs do you use and what for? (tick below)

      (i) Word Processing   1. Class register

                              2. Class timetable

                              3. Class cleaning roster

                              4. Summary of lessons

                              5. Test papers

                              6. Examination papers

Other (specify) ....

      (ii) Spreadsheet   1. Recording pupils' marks

                              2. Calculating class average

3. Sports budget

4. Field trip budget

Other (specify)..

....

(iii) Learning Channel (specify) ....

....

....

(iv) Internet (specify) ....

....

....

(v) GroupWise - E-mail (specify)..

....

....

16. What other computer programs do you use elsewhere and what for? (Be specific).

....

....

....

....

17. (i) How often do you use a computer per week? (give time in hours)..................................

(ii) How often do you use a computer at school per week? (give time in hours)....................

(iii) How often do you use a computer per elsewhere week(give time in hours)....................

18. How does computer usage in this school improve your secretarial skills?

(i) for school activities..

....

....

(ii) for the community at large ....

....

....

19. Do you use school computers for outside world communication?   1 No   2 Yes

20. How does computer usage (in this school) enhance your secretarial experience? (choose answer below)

    1. It has improve my administrative efficiency.

    2. It has improve my communication skills.

    3. It has made it possible for me to study independently.

    4. It has made it possible for me to access local and overseas information.

21. What other software would you like to satisfy your administrative needs? ....
....
....

C. IMPORTANCE OF COMPUTERS IN SCHOOL.

22. For administration, what do you think is being achieved with the aid of computers in the school? (choose below) :-

    1. As a management tool

    2. Notes summary

    3. Teacher training

    4. Exam papers

    5. Other (specify) ....
....

23. For administration, what do you think is not being achieved with the aid of computers in the school? (choose same options in 22 above) ....
....
....

24. In general, what do you see as the value of computers to the school? ....
....
....
....

25. Constraints to more use of computers. Be specific...
....
....
....

APPENDIX E

Myeka High School Educators' computer use monitoring sheet.

PLEASE FILL IN THE SHEET BELOW AFTER USING A COMPUTER (S).

PLEASE USE THE CODES GIVEN: THANKS IN CO-OPERATION.

NAME (initials) e.g. BD for Bongi Dube	DATE	STRAT TIME	FINISH TIME	INDIVIDUAL (Please tick)	CLASS (Please tick)	*COMPUTER PROGRAM USED (See codes)	*ACTIVITY/ ACTIVITIES PERFORME D (See codes)	TIME SPENT

CODES

*COMPUTER PROGRAMS
LC=Learning Channel
WP= Word Processor
SS= Spreadsheet
GEM= GroupWise E-mail
I= Internet

*ACTIVITY PERFORMED
NS= Notes summary
A= Administration (class)
TP= Test paper
EP= Exam paper
O= Other (Please specify)...

APPENDIX F

Myeka High School educators' focus group discussion topics.

Focus group discussion topics administered to Myeka High School educators: computer users, partial users and non-users

A. PERCEPTIONS ABOUT SCHOOL COMPUTER USE.
1. Are you interested in using the school computers? Why?
2. How were the school computers introduced to you, originally?
3. Did you find it easy for you to use the new technology? Why?
4. What constructive criticisms do you have on the introduction of solar powered computers to this school?
5. What suggestions for improvement, do you have on the introduction and use of solar powered computers in this rural school?

B. EXTENT OF COMPUTER USE.
1. What are the uses of computers for educators?
2. What knowledge and skills of computer use do you have?
3. What changes in the school management would provide you with more time to use the school computers?
4. What inhibits you from using school computers?

C. COMPUTER MAINTENANCE
1. What problems do you have concerning keeping computers in good condition and working order?
2. What do you, as educators, do if there is a computer technical problem?
   2.1. What computer problem(s) are you qualified to fix? (general process, software, hardware, network, other).
3. To whom do you report technical problems?
4. Who is responsible for the maintenance of the school computers i.e. the network and the Internet Explorer?

APPENDIX G

Focus group discussion permission request letter.

University of Natal
Discipline of Community Resources
Private Bag X01
Scottsville
3209
07 March 2001

The Headmaster

Myeka High School

P. O. Box 2539

Mbozamo

Inanda

4310

<u>Request for permission to conduct focus group discussions with educators</u>

Dear Mr Zwane

With your permission, I would like to conduct one hour focus group discussion on the 14th of March 2001 at 11:00, with each of the following groups of educators.

GROUP A

1. ZC Mngadi
2. BE Ndlovu
3. ON Ndlovu
4. G Shezi
5. R Singh

GROUP B

1. SB Madondo
2. NN Mayisela
3. S Nandlal
4. TJ Ndlovu
5. BP Sibisi
6. CC Xulu

GROUP C

1. PT Chamane
2. N Gumede
3. W Gwala
4. BL Khumalo
5. LP Magwaza
6. JC Majola
7. SM Majozi
8. MK Mbeje
9. ZR Msomi
10. TD Ngema
11. M Zibane
12. T Chiliza

The discussions will be on these educators' extent of computer use.

Yours faithfully

Bongi Dube (Research Student, University of Natal, Pietermaritzburg,Community Resources Discipline).

APPENDIX H

Myeka High School headmaster's interview questions.

1. How much money is spent on computer maintenance per month?

2. How much money is spent on repairing/servicing computers per month?

3. What effects do computer maintenance costs have on the school's budget?

4. What effects do computer maintenance costs have on computer use?

APPENDIX I

Myeka High School raw data

	gender	teachexp	texpmyek	placeori	local	typing	maths
1	2	10	10	1	2	1	1
2	2	9	9	3	2	1	1
3	1	4	2	1	3	1	3
4	2	5	5	1	2	1	1
5	1	11	6	2	2	1	3
6	2	10	10	1	2	1	1
7	2	7	7	3	2	1	3
8	2	20	11	3	2	1	1
9	2	18	16	1	2	1	1
10	1	5	5	1	2	1	1
11	2	3	3	3	2	1	1
12	2	14	7	3	2	1	1
13	1	14	1	3	2	1	1
14	1	14	10	3	2	1	1
15	1	18	18	1	2	1	1
16	2	15	4	2	2	1	1
17	2	19	10	3	2	1	1
18	2	2	2	2	2	1	1
19	2	6	6	1	2	1	1
20	2	14	1	3	2	1	3
21	1	10	10	3	2	3	1
22	1	20	13	1	2	1	1
23	1	7	6	1	2	1	1
24	1	0	0	1	2	1	3

	account	technid	indusart	physics	geo	biology	ecos
1	1	1	1	1	1	3	1
2	3	1	1	1	1	1	1
3	1	1	1	1	3	1	1
4	1	1	1	1	1	1	1
5	1	1	1	3	1	1	1
6	1	1	1	1	1	1	1
7	1	1	1	1	1	1	1
8	1	1	1	1	1	1	1
9	1	1	1	1	1	1	1
10	1	1	1	1	1	1	1
11	3	1	1	1	1	1	3
12	1	1	1	1	1	1	1
13	1	3	3	1	1	1	1
14	1	1	1	1	1	1	3
15	1	1	1	1	1	1	1
16	1	1	1	1	1	1	1
17	1	1	1	1	1	1	1
18	1	1	1	3	1	3	1
19	1	1	1	1	1	1	1
20	1	1	1	1	1	1	3
21	1	1	1	1	1	3	1
22	1	1	1	1	3	1	1
23	1	1	1	1	3	1	1
24	1	1	1	1	1	1	1

	hotel	homeeco	buseco	genscie	catering	agricsci	travel
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20	1	1	1	1	1	1	1
21	1	1	1	1	1	1	1
22	1	1	1	1	1	1	1
23	1	1	1	1	1	1	1
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3	1	1	1	1	1	2	-99
4	1	1	3	1	1	2	-99
5	1	1	1	1	1	3	3
6	1	1	1	3	1	2	-99
7	1	1	1	1	1	2	-99
8	1	1	1	3	1	2	-99
9	1	1	1	1	1	3	4
10	1	3	3	1	1	3	3
11	1	1	1	1	1	3	5
12	1	1	1	3	1	3	2
13	1	1	1	1	1	3	2
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17	3	1	1	1	1	2	-99
18	1	1	1	1	1	3	4
19	1	1	1	1	1	3	1
20	1	1	1	1	1	3	4
21	1	1	1	1	1	2	-99
22	1	1	1	1	1	2	-99
23	1	1	1	1	1	3	3
24	1	1	1	1	3	3	5

	qualif	qualftyp	institut	usescomp	complite	usecompe	wordpro
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24	3	2	2	3	3	2	3

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4	1	1	1	1	3	1	1
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21	3	3	3	3	3	3	3
22	1	1	1	1	1	1	1
23	3	3	1	1	3	3	1
24	1	1	3	3	3	3	3

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9	3	3	1	1	1	1	1
10	1	1	1	1	1	1	1
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20	3	3	3	1	1	1	1
21	3	3	3	3	3	1	1
22	1	1	1	1	1	1	1
23	3	3	3	3	1	1	1
24	3	3	3	1	1	1	1

	email	otherp	comphrs	scomphrs	ecomphrs	class	communit
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4	1	1	-99	-99	-99	1	1
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7	1	1	-99	-99	-99	1	1
8	1	1	-99	-99	-99	1	1
9	1	1	3	3	0	4	1
10	1	1	-99	-99	-99	1	1
11	1	3	5	3	2	3	2
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14	1	1	10	10	0	3	1
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23	3	1	1	1	0	3	1
24	1	1	5	5	0	4	1

	outcommu	admineff	comskill	indestu	infor	addisoft	achievem
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7	1	1	1	1	1	1	3
8	2	1	1	1	1	1	3
9	2	3	3	3	1	4	3
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21	3	3	1	1	3	4	3
22	3	1	1	1	1	3	3
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22	3	1	1	1	1	1	1
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24	3	3	3	3	1	3	1

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21	3	1	1	1	1	1	1
22	1	3	1	1	1	3	1
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24	1	1	1	1	1	1	3

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4	2	-99	-99	-99	-99	-99	2
5	3	2000	3	2	2	-99	2
6	2	-99	-99	-99	-99	-99	2
7	2	-99	-99	-99	-99	-99	2
8	3	2000	2	2	2	-99	2
9	3	2000	4	2	2	-99	2
10	2	-99	-99	-99	-99	-99	2
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12	3	2000	2	4	2	-99	2
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22	2	-99	-99	-99	-99	-99	2
23	2	-99	-99	-99	-99	-99	2
24	3	2000	3	2	2	-99	2

	compuse	compuset	progtype	msword	weathers	mediap	msexcel
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4	2	-99	-99	-99	-99	-99	-99
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9	3	5	3	3	1	1	3
10	3	4	3	3	1	1	3
11	3	1	3	3	1	1	1
12	3	2	3	3	1	1	3
13	3	6	3	3	1	1	3
14	3	3	3	3	1	1	1
15	3	2	3	3	1	1	1
16	2	-99	-99	-99	-99	-99	-99
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18	3	2	3	3	1	1	3
19	3	5	3	3	1	1	3
20	3	1	3	3	1	1	1
21	3	2	3	3	1	1	3
22	3	3	3	3	1	1	1
23	3	4	3	3	1	1	3
24	3	4	3	3	1	1	3

	wperfect	internet	games	learnc	mspowerp	wordpad	benefits
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4	-99	-99	-99	-99	-99	-99	3
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6	-99	-99	-99	-99	-99	-99	1
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20	1	1	1	3	1	1	3
21	1	1	1	1	1	1	3
22	1	1	1	1	1	1	3
23	1	1	1	1	1	1	3
24	1	1	1	1	1	1	3

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4	3	1	1	1	1	1	1
5	1	1	3	3	1	1	1
6	-99	-99	-99	-99	-99	-99	-99
7	3	1	1	1	1	1	1
8	3	1	1	1	1	1	1
9	1	1	3	1	1	1	1
10	1	1	1	3	1	1	1
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21	3	1	1	1	1	3	1
22	1	1	1	1	1	3	1
23	3	1	1	1	1	1	1
24	3	1	1	1	1	1	1

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4	1	-99	-99	-99	-99	-99	-99
5	3	3	3	1	1	1	1
6	1	-99	-99	-99	-99	-99	-99
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9	3	3	3	1	1	1	1
10	3	1	1	3	1	1	1
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23	3	3	1	1	1	1	1
24	3	1	1	1	1	3	1

	service
1	-99
2	-99
3	3
4	-99
5	1
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10	1
11	1
12	1
13	1
14	1
15	1
16	1
17	1
18	1
19	1
20	3
21	1
22	1
23	1
24	1

APPENDIX J

Myeka High School focus group discussion- qualitative data categories

MYEKA HIGH SCHOOL FOCUS GROUP DISCUSSION QUALITATIVE DATA CATEGORIES

Category	Computer users	Computer partial users	Computer non - users
Computer introduction	Principal Other educators Companies and NGO Not formally introduced	Principal and company Not formally introduced	Companies Other educators Not formally introduced
Interest in computer use	Yes, but lack skills Yes, but technical problems Yes, but constant power failure	Yes, for examination papers Yes, lesson preparation	Yes, notes summaries Yes, lesson preparation
Familiarity with computers	Misunderstanding Few computers Time limited Training needed	Misunderstanding Time limited Training needed	Time limited Training needed
Computer usefulness	Management activities Information source Lesson preparation	Lesson preparation	Lesson preparation
Knowledge and skills of computer use	Typing Changing cartridges Retrieving information	Retrieving information Typing	Typing
Programs can use	Internet-information searching MS Word- notes and examination Leaning Channel- lesson presentation, notes summaries, previous examination paper MS Excel- marks report	MS Word- notes and examination Internet-information searching Leaning Channel- lesson presentation, notes summaries, previous examination paper MS Excel- marks report	None
Changes to provide more time	Timetable shortened	Timetable shortened	More computers for each school department Timetable shortened- free 30 minutes left after school

Category	Computer users	Computer partial users	Computer non - users
Constraints	Too tight school programme Inadequate transport	Too tight school programme Overcast weather	Too tight school programme Too few computers Other educators personalise computers Computers need repair Lack of interest
Maintenance problems	Irresponsibility of learners Lack of air-conditioners Dust	High maintenance costs Dust Lack of technical support	Lack of air-conditioners Dust
Maintenance responsibility	Solar Engineering Service	Solar Engineering Service	Do not know
Constructive criticisms on solar technology introduction	Decrease's educators confidence when power goes off	Unreliable power supply	Slows down process of grid extension
Suggestions for improvement of solar technology	Provision of grid electricity Upgrade solar system-more solar panels School stationed technician Educator training in solar technology maintenance	Provision of grid electricity Upgrade solar	

APPENDIX K

Myeka High School computer generated learners' answer sheet.

NAME: GRADE:11 A

PHYSICAL SCIENCE ANSWER SHEET

MAKE A CROSS ON THE LETTER OF THE ANSWER CHOSEN

1.1	(A)		(B)		(C)		(D)
1.2	(A)		(B)		(C)		(D)
1.3	(A)		(B)		(C)		(D)
1.4	(A)		(B)		(C)		(D)
1.5	(A)		(B)		(C)		(D)
1.6	(A)		(B)		(C)		(D)
1.7	(A)		(B)		(C)		(D)
1.8	(A)		(B)		(C)		(D)
1.9	(A)		(B)		(C)		(D)
1 10	(A)		(B)		(C)		(D)

APPENDIX L

Myeka High School computer generated learners' record.

GRADE 10 A MARKS

SURNAME	NAME	ASSIGN	Test 1 / 65	Assgn %	Test %	Exam / 135	Exam %	GR. TOT / 300
CELE	INNOCENT	23	45	57.5	69.23	32	23.704	150
HLAMBISA	RITTA	38	36	95	55.38	96	71.111	221
GWALA	MACPHESON	34	56	85	86.15	75	55.556	227
GUMEDE	REUBEN	37	59	92.5	90.77	127	94.074	277
MBATHA	PATRICIA	13	37.5	32.5	57.69	62.5	46.296	136
SHEZI	PRINCESS	32.5	32.5	81.3	50	52.5	38.889	170

T.M. CHILIZA

APPENDIX M

Myeka High School computer generated learners' test sheet.

GRADE 9 COMP. TEST1   TOT. [36]

NAME:..

....

Question1.
State whether the following statements are T/F

1.1 Word processing is the the computer programe that allows you to calculate numbers. ....
1.2 Witth word processing you can also check the spelling. ....
1.3 The is always 2 spaces before te full stop. ....
1.4 To move around your text you use your shift together with arrow key. ....
1.5 You can use the mouse to click on the place you want to go. ....

Question 2

2.1 Mention 3 advantages of using word processor over any ancient ways of writing documents.
....
....
....
....

2.2 Explain how to get into "WORD"?
....
....

2.3 How can you highlight without using a mouse?

....
....
....
2.4 How to get out of "WORD"?

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

Question 3

Fill in the missing words

To leave a space between the words you press (a)........................., bar and
(b)....................... ,key to leave empty lines between the paragraphs.
The (c) ...., is used to write one letter/character in upper case and ,(d)
......................., is used to select the top

APPENDIX N

Myeka High School computer generated learners' examination paper.

ENGLISH LANGUAGE

EXAMNER : NDLOVU J.T

PAPER 1
GRADE 11
TIME: 2 HOURS
MARKS: 80

INSTRUCTIONS TO CANDIDATES

READ THESE INSTRUCTIONS CAREFULLY BEFORE ANSWERING THE QUESTIONS.

1. ANSWER ALL QUESTIONS.
2. SECTION   A   COMPREHENTION   (35)
           B   SUMMARY   (10)
           C   LANGUAGE   (35)

APPENDIX O

Myeka High School computer generated learners' result sheet.

c

KWAZULU- NATAL
DEPARTMENT OF EDUCATION AND CULTURE

MYEKA HIGH SCHOOL
P.O. BOX 2539, MBOZAMO, INANDA, 4310

JUNE EXAMINATIONS 2000

RESULT SHEET

NAME: _____ GRADE 11B

NO. OF DAYS ABSENT: _____

SUBJECT	GRADE	MAX. MARK	PUPIL'S MARK	CLASS AVERAGE
ZULU				
ENGLISH				
BIOLOGY				
GEOGRAPHY/ TOURISM				
SPEECH & DRAMA				
HOME ECO. / HISTORY				
TOTAL				

RESULT: _____

SCHOOL RE-OPENS ON :   **MONDAY, 17 JULY 2000**

FORM TEACHER: _____
                                    MR M.K. MBEJE

PRINCIPAL: _____

NOTE: 1. Ringed marks denote failure.
            2. This report is issued without any alterations.

SCHOOL STAMP

APPENDIX P

Myeka High School computer generated Learning Channel Mathematics summary page.

Search [   ] O Go

O Home | O My Sp

Maths

Please select from:

Number and algebra

- Using and applying mathematics
- Understanding the basics of numbers
- Fractions and decimals
- Using basic number skills
- Equations and inequalities
- Lines, simultaneous equations and regions
- Using brackets in algebra
- Estimation and approximation
- Sequences and formulae
- Using proportion and proportionality
- Working with graphs
- Simplifying algebraic expressions
- Quadratic equations
- Irrational numbers
- Application of transformations
- Rates of change and areas under graphs
- Modelling to understand relationships
- Calculators and computers

Shape, space and measures

- Recognising shapes
- Transformations

APPENDIX Q

Myeka High School 2001 matriculation results analysis.

MATRICULATION RESULTS ANALYSIS 2001

Subject	Number of learners	Symbols obtained									Pass rate %
		A	B	C	D	E	F	G	GG	H	
Accounting	32	0	1	9	11	7	4	0	0	0	100
Biology	16	0	0	0	0	0	2	0	9	5	12.5
Business Economics	32	0	0	6	6	12	7	0	1	0	96.8
Economics	32	0	0	0	9	15	7	0	1	0	96.8
English	60	0	0	0	1	16	36	0	6	1	88
Geography	25	0	0	0	1	9	9	0	4	2	76
History	05	0	0	0	2	3	0	0	0	0	100
Home Economics	11	0	0	0	1	7	3	0	0	0	100
Mathematics	44	0	0	0	1	2	7	0	5	29	22.7
Physics	12	0	0	0	0	1	6	0	3	2	58
Speech and Drama	16	0	0	0	6	10	0	0	0	0	100
Travel and Tourism	13	0	0	0	8	2	0	0	0	0	100
Zulu	59	1	12	3	17	6	0	0	0	0	100

<u>Myeka High School 2001</u> =74.57

Prepared by Myeka High School Head of Department: Mr ON Ndlovu.

APPENDIX R

Myeka High School computer generated School Governing Body and parents meeting invitation letter.

Malunga okubuswa kwesikole nabazali.

Kamuva-nje sekutholakele kunesidingo esikhulu sokuqeqesha kanye nokudlulisela amakhono okuphatha nokubuswa kwezikole kulandela ukudluliselwa kwamandla kumalunga okubuswa kwezikole(SGB's)

Ukuze uthole lamakhono obuholi,uyamenywa kwi-workshop ehlelwe abakwa-Valley Trust ezokuba se-Myeka High School.

USUKU	:22 September 2001
ISIKHATHI	:09 H 30
INDAWO	:Myeka High School.

_____

Principal

_____

Acting Secretary

School Governing Body members and Parents.

Recent findings suggest a great need for the skills training and empowerment in terms of management and governance of schools following the delegation of these powers to SGBs.

To receive these skills and other leadership skills,Valley Trust has organised a workshop at Myeka High School in which you are invited.

DATE	:22 September 2001
TIME	:09 H 30
VENUE	:Myeka High School

_____

Principal

_____

Acting Secretary

APPENDIX S

Myeka High School observational findings.

MYEKA HIGH SCHOOL OBSERVATIONAL FINDINGS

Date of visit	Observation
15-04-2000	Physical and Maths educator- using a computer to design Physical Science learners' answer sheet. **Interview**: The school computers are mainly used for • Accounting, Biology, Geography, Maths and Physical Science. • Train educators But computers cannot be used with a photocopier at one time
01-06-2000	English, Biology and Typing educator- entering learners' marks using MS Excel. **Interview**: Also uses MS Word to type English poems so that each learner has a copy. Uses Learning Channel for Biology lesson summaries Uses GroupWise -E-mail to the Mercury newspaper industry to asking newspaper copies for learners to read article and improve their English language
22-06-2000	English and Drama Studies educator- using MS Word to type summary of a lesson. Business Economic educator - using MS Word to type summary of a lesson. **Interview** : Computer produced summary of lesson makes teaching easier.
29-08-2000	No one found in the computer room. **Interview**: The principal said the school had ran short of the solar electricity for two weeks, therefore, the educators were not using the computers.
30-08-2000	Accounting, Home Economics and Physical Science educators- each using MS Word to prepare trial exam papers. **Constraint:** While the educators busy working the power went off, one was not yet saved her file. The power went off because other educators were making copies of trial exam papers using a multicopy machine which educators said it consumes a lot of energy. Due to limited power supply the educators were asked to stop photocopying and typing was then well done. Biology educator lesson- using MS Word to type summary of a lesson. **Constraint:** One educator's floppy disk got stuck in the disk drive and she could not extract it, she immediately stopped using the computer and went to the classroom and wrote the notes on the chalkboard.
06-09-2000	English and Drama Studies educator: using MS Word for lesson summary Business Economics educator : using MS Word for lesson summary **Interview** : Computer produced summary of lesson makes teaching easier.
13-09-2000	Two learners in Grade 11 and 12 respectively, playing games under the supervision of Accounting educator.
18-09-2000	Accounting educator: using MS Excel entering learners' trial exam marks. **Interview**: It appeared that most of educators give her hand written marks and she does the entering and calculate averages
23-02-2001	Newly appointed secretary in the Principal's office: using MS Word typing parents' meeting invitation letters.

During the visits after 23-02 -2001 no one was found using the computers in the computer room.