All stakeholders in South Africa's schooling system are having to confront the reality that computers will play a more prominent role in the teaching and learning process.

The national survey of computers in schools is the first in-depth analysis of the extent and ways in which computers are being used in South African schools.
It provides the first set of base-line data against which the use of computers in schools can be measured.

The Computers in Schools report gives an overview of the national survey and provides an accurate picture of computer resources. It also explores the use of computers in teaching and learning; the funding and maintenance of computers at schools; as well as the obstacles to the further use of computers in the schooling system.

Education institutions, private sector and non-government organisations, parent and teacher bodies, and individuals actively involved in the promotion of computers in education will be able to draw important lessons about the environment shaping this dynamic process.

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Education Policy Unit
University of the Western Cape

Sponsored by the International Development Research Centre

Computers in schools

Education Policy Unit, UWC

COMPUTERS IN SCHOOLS

A national survey of Information Communication Technology in South African schools

Project Co-ordinators:
Paul Lundall and Colleen Howell

Education Policy Unit,
University of the Western Cape

Sponsored by the International Development Research Centre

Executive summary

Background and introduction

In 1997 the National Centre for Educational Technology and Distance Education in the National Department of Education, following on from the Technology Enhanced Learning Initiative (TELI), identified the need for the development of clear and comprehensive policies for addressing the development of appropriate and sustainable Information Communication Technology (ICT) capacity in South African schools. To this end a research process began in May 1998 to undertake a national survey into ICTs in South African schools.

The main objective of the study was to investigate the nature and extent of ICT provision in the schooling sector. More specifically, by mapping what ICTs are being used in the schools, the manner in which they are being used and the organisational arrangements used to facilitate their use, a picture emerged of the school ICT environment.

Equally important was to identify factors that could be regarded as enabling or hindering conditions to the use of ICTs in schools. All these issues were used to provide insights for key policy considerations such as the creation of equity, facilitating quality in the use of ICTs and to help in identifying key areas for strategic interventions towards achieving these objectives.

Funding to undertake the research was received from the Canadian International Development Research Centre (IDRC) and the research process was placed under the direction of the Education Policy Unit (EPU) at the University of the Western Cape. In undertaking the survey the EPU also entered into collaborative relations with the Science and Technology Policy Research Centre based at the University of Cape Town, Miller Esselaar and Associates, an independent consulting agency, as well as the Centre for Inter-Disciplinary Studies at the University of Stellenbosch. Throughout the duration of the project, the research team drew on the expertise of a range of stakeholders including members of academic institutions, educators from schools, members of non-governmental organisations (NGOs) operating in the field and other relevant organisations.

The research process

A combination of quantitative and qualitative research methods was used in the study.

- A literature survey was done to contextualise the study within the education and policy environment in South Africa and to draw on the experiences of other countries in the area of ICT policy and use in education.
- A postal survey with two specifically designed questionnaires were sent to a sample of South African schools throughout the nine provinces. The sample of schools was derived from the 1996 Human Sciences Research Council (HSRC) School Register of Needs Survey that indicated the presence or absence of one or more computers in all schools in South Africa. All schools with one or more computers were sent a questionnaire as well as a 10% random

sample of schools from those who did not have computers in 1996. Two questionnaires were sent to each of these schools. One questionnaire was aimed at schools with computers and one for those without. Schools were requested to send back the questionnaire that was appropriate to their present status. (This was done to ascertain whether some schools had obtained or done away with computers between 1996 and 1998 when the research began.)

- The information obtained through the survey was deepened through interviews with key stakeholders and site visits to schools in three provinces.
- A brief survey was also undertaken with important players in the private sector to explore the nature and extent of their involvement in ICT provision and support in schools.
- A similar investigation was done on the work of organisations in the NGO sector that support ICT development in schools in South Africa.
- Once all the data had been collected a detailed analysis was made of all the research findings. Finally, the key findings of the research were synthesised into this report.

Contextualising the study of ICTs in education

A review of literature and studies pertinent to this study was undertaken in order to particularly explore the use and impact of ICTs in developed and developing countries. An attempt was made to look at the area of teaching and learning as well as the administrative, managerial and technical prerequisites that are necessary for sustained ICT development and use. The literature indicates strongly that the effective use of ICTs in a country impacts strongly on the competitiveness of that economy within the global marketplace as well as the ability of governments to deliver on their social goals. The development of ICTs in education are seen as an important priority by most countries.

Experiences from other countries, whatever their stage of development, show that factors which accompany the successful implementation of ICTs in schools are networks of connectivity and structured and continuous programmes to train teachers to use the new technology for educational purposes. The literature also shows that ICTs should be integrated from the beginning into the teaching and learning process, as well as the administration and management systems for the path of development to be effective. At the same time studies from other countries show that as teachers become more confident so the levels of integration and innovation increase.

The most effective policy initiatives in this area internationally have been those that are comprehensive in the scope of issues that they address and in the integration of different areas of application. So where policies on ICTs in education have been linked, for example, to economic development initiatives through ICTs, implementation has been coherent and effective. Partnerships between the central role players such as government, the private sector and NGOs appear to be especially crucial here.

Equally important is the need for ICT planning to be based on a comprehensive understanding of the existing needs and priorities of a country. There has to be recognition of the disparities in general resource provision so that questions of equity or inequity can be addressed.

With regard to the schooling and policy context in South Africa, the review of existing policies, demographics and educational practices, show that comprehensive and innovative policies do exist which support the progressive development of ICTs in schools. However, prevailing inequalities and pressures on the education system also have the potential to undermine effective ICT development. Of

particular importance are factors such as: rural/urban disparities; poorly trained teachers; the reliance on school fees for meeting non-personnel costs in schools such as ICTs; and struggles of provincial departments to manage the many change processes and policies with which they are confronted. It is against this background that the findings of the study need to be considered and addressed.

Overview of findings from survey questionnaires

A significant amount of data was collected through the survey. Once all the data was captured a first level of analysis was done to explore the responses of schools (and other stakeholders) to the different questions asked in the questionnaires. The frequency of responses was recorded and compared to significant grouping variables such as 'type of school', 'province' etc. This was done to investigate whether these variables impacted on the pattern of responses. Below is an overview of the key findings from this level of analysis.

Schools with computers

In 1996 2 311 schools were registered in the HSRC database as having one or more computers. 962 of these schools returned a questionnaire for the survey. This constitutes a response rate of 42.8%, which is regarded as a very good response rate for postal surveys. The realised sample (returned questionnaires) was sufficiently similar to the target population (schools with computers in HSRC data base) in terms of criteria such as school type and province to be regarded as truly representative of all the schools with computers in South Africa. This means that the data received from these schools is sufficiently representative to show accurately the patterns that characterise use of ICTs at South African schools.

With this background in mind, the summary which follows presents the central findings from the questionnaire designed for schools with computers.

ICT resources in schools

- Despite some extreme variations, schools in the provinces of Gauteng and the Western Cape have on average a better ICT infrastructure than schools in the Eastern Cape, Northern Cape and Northern Province. Schools in the Free State, KwaZulu-Natal, Mpumalanga and the North West province hold an intermediate position.
- E-mail facilities are beginning to be used more extensively in many schools as a management and administrative resource and also as a teaching resource.
- Internet use is becoming more common in a wide spectrum of schools across all provinces. For instance, nearly half (49%) of schools in the Western Cape and Gauteng, which have computers, have access to the Internet.

Teaching computer literacy

- In both primary and secondary schools, the teaching of basic computer principles and word processing skills form the most important component in the teaching of computer literacy.
- At the secondary level, a movement towards an increase in the level of complexity of the skills taught is evident.
- There are no significant differences in the number of female learners and male learners that are being taught computer skills.
- On average, learners in primary schools spend less than one hour per week learning computer skills. In secondary schools, the time spent learning computer skills tends to increase but is significantly influenced by whether Computer Studies is offered as a school subject or not and by the number of computers that schools possess.

Computer use in the learning areas

- Computers tend to feature fairly extensively in the learning areas of Language and Mathematics, Natural Sciences and Technology, and less in Humanities and Arts.
- In Grades 1 to 7 computers tend to be used to perform drill and practice, and problem-solving exercises. From Grade 8 upwards, computers tend to be used for a greater variety of purposes in the teaching and learning process, although the presentation of assignments and problem-solving exercises tend to predominate.
- Drill and practice exercises although less prominent, continue to be used in Grades 8 to 12.
- The principal factors that prevent schools from using computers as a tool for teaching and learning are:
  - insufficient funds.
  - an insufficient number of computers.
  - lack of computer literacy among teachers.
  - lack of subject teachers trained to integrate computers into different learning areas.
  - the absence of a properly developed curriculum for teaching computer skills.

Computer Studies as a subject

- 66% of secondary schools with computers offered Computer Studies as a matric subject.
- Schools offering Computer Studies are more likely to have the resources and capacities for a relatively better ICT infrastructure.
- Normally, the offering of Computer Studies is also associated with a dedicated teacher responsible for its teaching.

Funding and maintenance

- The majority of schools with computers (73%) indicated that the school had a specific budget for computers, but such budgetary organisation was more prevalent at schools that had more than 10 computers.
- The computer budgets of schools tend to be devoted to the purchase of computers, software and the maintenance of computers.
- The revenue sources through which items on the computer budget are financed are derived mainly from allocations on school fees and funding activities and also through financial donations from parents and the private sector.

Start-up date and teacher confidence

- The attitudes of teachers towards the use of computers in education are in general positive.
- Schools that have acquired a comparatively better ICT infrastructure started using computers from an earlier period; 81% of schools with 30 or more computers indicated that they started before 1995. A lower proportion (62%) of schools with 10 or less computers started using these before 1995.
- A majority of schools identified the lack of available staff trained to use computers as the biggest hindering condition to the effective use of computers. However, only 5% of schools prioritised expenditure on this item in their ICT budget.
- Many schools indicated that some teachers at the school do have access to technology related professional training opportunities that take place outside the school. The largest proportion of teachers (44%) who fall into this category had access to courses run by the Department of Education.

Computer use after school hours

- A minority of pupils at 59% of schools make use of school computers after school hours.
- After hours computer use is being done to a slightly greater extent at secondary schools and also appears to take place more extensively at schools which started using computers before 1990 and among those that offer Computer Studies as a subject.

- At some schools, outside groups attend classes after school hours during which they use the school computers. Two-thirds of these schools (63%) charge a fee and more than half involve schools that have 30 and more computers.

Schools with no computers

Out of the 10% random sample of schools listed in the HSRC database as having no computers, only 444 returned a questionnaire. This reflects an 17.9% response rate from the 2 480 questionnaires designed for schools with no computers which were sent out. Even for a postal survey a response rate of 17.9% is regarded as relatively low. Given that this in fact is only 17.9% of 10% of the whole population, the realised sample is probably too small to be regarded as representative of the entire population of schools with no computers in South Africa. While we therefore regard the survey findings from these schools with caution, the data still shows interesting patterns among schools with no computers.

Even though differences occurred between provinces, a large proportion of schools without computers acknowledged receiving some material and resource benefits since 1996. However, huge backlogs still remain. Schools without computers are more likely to experience deficiencies in equipment such as VCRs, radios, tape recorders and slide projectors. In order of rank, the key factors inhibiting schools from acquiring computers are:

- an absence of electricity.
- lack of funding.
- insufficient building space.
- a lack of available and trained staff.
- poor security.

Despite the lack of resources, teachers at schools generally express positive feelings about the value of computers at schools. The most popular reason given about why a school should start using computers is to help prepare students for the future (60%). Teachers at most schools in the survey are keen to participate in the management and development of computers at their school. Schools also asserted that there is a need for teachers to be trained to use computers before the school starts to use these.

The NGO sector

There are a number of NGOs operating nationally and provincially in the schooling sector. Some of these take the form of networks offering a range of services and co-ordinating functions. Others carry out specific functions, e.g. technical support on infrastructure and maintenance; professional development of teachers and support of teachers in integrating ICTs into the curriculum. Many NGOs are sustained through commitment and dedication from the people who work in them, but donor funding has also been essential to sustain these operations.

The Private sector

Private sector involvement with ICTs in South African schools is embryonic at this stage. With respect to innovative offerings and contracts with schools, some software companies offer schools products that can be licensed at reduced rates. No major suppliers, distributors or retailers of computers that specifically target the educational market for primary and secondary schools were identified. Nor have they devised creative ways of exploring this market. Business providers of training support to teachers and learners are however beginning to establish a presence in the field.

Synthesis and analysis of the research findings

A second level of analysis was undertaken to explore the correlation between different factors and their influence on ICT provision and use in more depth. These chiefly took the form of

indexes derived from a number of variables with similar or comparative attributes that were merged to develop a specific index. The principal indexes used are: the *Index of ICT Sophistication* (resourcing levels) and the *Index of ICT Usage* (reflecting degrees of use). Below is a summary of the key trends that emerged from the analysis.

Factors that enable or restrict start-up

Schools that are unable to acquire the basic material resources for teaching and learning are not likely to be successful in acquiring ICTs. At the same time, schools that meet the necessary material conditions for using ICTs in teaching and learning require support and intervention from outside agencies. Support agencies include the national and provincial departments of education, businesses and NGOs as well as other nearby schools that are already using ICTs effectively.

Schools that successfully acquire and use ICTs demonstrate a number of enhancing conditions and capacities. These include:

- relatively smaller class sizes.
- the ability of parents to meet additional financial costs involved.
- the ability to integrate ICTs effectively into the normal school routine.
- the presence of a dedicated computer teacher at a school.
- a tendency to have had computers for a comparatively longer period of time.

The comparison of schools without computers and those with computers shows clearly that the former group is disadvantaged in ways that make effective start-up nearly impossible. The most basic infrastructural conditions (electricity, inadequate classrooms, insufficient security) are not present in large numbers of schools. Added to this are large classes, lack of funding to acquire computers and a lack of trained staff to manage ICTs. The fact that larger proportions of schools do not meet these basic minimum conditions is an indication of the huge challenge that South Africa faces if it wishes to bring its learners into the information age. This challenge is coupled with the reality that where relatively high levels of ICT resources exist, these have largely been paid for through parent's contributions. This has important implications not only for the start-up of ICTs but also for the creation of equity between schools.

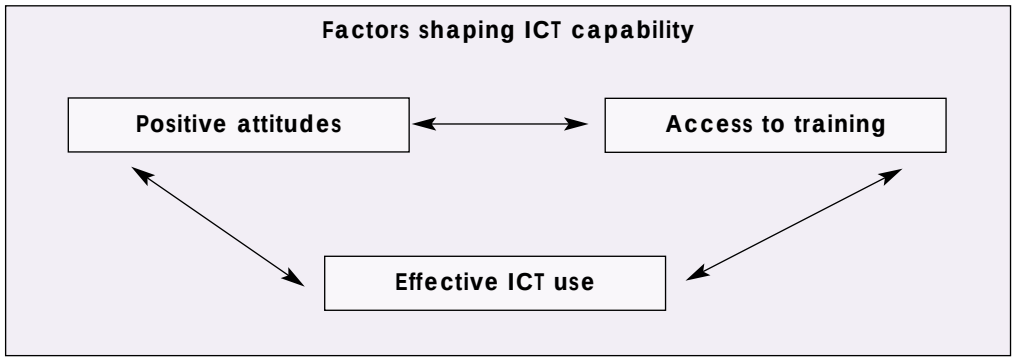
Effective use of ICTs

Effective use of ICTs in education refers to the positive contribution ICTs make towards the process of teaching and learning. In this study 'effective use' of ICTs was explored by looking at the following:

- The domains in which computers are being used in the school such as teaching and learning, administration, management, etc. This also includes the specific learning areas that computers are used for in the classroom.
- The purposes computers are used for in the teaching and learning process, such as drill and practice type work, problem-solving, etc.
- The types of software that are used.
- The ways in which learners engage with computers, (i.e. primarily through group work or individual work).

By comparing the responses of schools in all these different areas, an *Index of Usage* was constructed to demonstrate the degree of innovation and sophistication that schools are demonstrating in ICT use. This index was then compared to a number of key variables. The following are the trends that emerged:

- High and medium levels of use correlate with lower than average teacher to pupil ratios and low levels of use correlate with higher than average teacher to pupil ratios.
- Schools that started using computers prior to 1990 are more likely to fall into the high use category.
- Levels of resources have a particularly important impact on ICT usage. Schools that



are better equipped have a greater propensity and capacity to make more effective use of ICTs in the teaching and learning process.

- High use also correlates with the provision of e-mail facilities to more than 50% of teachers, greater after hours use by students and teachers, access by a greater percentage of learners to computers at home, and a propensity among secondary schools to offer Computer Studies.

It is also pertinent to note that while the nature and extent of ICT use is substantially influenced by access to adequate resources, there are some schools that are able to overcome resource barriers and move towards effective ICT usage. Although it is difficult from the findings of the study to postulate why this happens, inferences from the questionnaires and the interviews point to the presence of one or more of the following factors in those schools which have low levels of resources but which show high levels of innovation. The presence of a 'champion' among educators, parents or members of the surrounding community, a supportive network among educators in the same region and strong support from the provincial education department.

ICTs and human resources

Effective use of ICTs requires the establishment of an ICT capability and infrastructure that is conducive to teaching and learning. An established infrastructure means that basic ICT resources are in place. It also means that educators are present who are equipped with the skills, knowledge and confidence to creatively insert ICTs into the teaching and learning process.

Cluster analysis using the *Index of ICT Usage* showed clearly that teacher attitudes are both affected by, and impact directly on, levels of ICT usage, with high level usage clustered closest to positive teacher attitudes. Similarly, there is a strong correlation between low levels of use and negative attitudes. The analysis also shows that where there are a number of barriers towards the use of ICTs in schools (e.g. lack of funds), it is more likely that teacher attitudes towards ICT usage will be negative.

Positive attitudes to ICTs in schools appear to have been enhanced through the access teachers have had to relevant training. Schools where teachers had a relatively high level of access to training opportunities expressed positive attitudes to the use of ICTs. The opposite prevailed for schools that had limited access to training opportunities. The survey data also shows that schools that have had greater access to professional development are those that possess a high level of resources. Schools with low access to training have a strong correlation to low resource levels. Thus while access to training clearly affects the attitudes of teachers towards ICT usage, training is itself an issue affected once again by resource levels.

With regard to the gender disparities between ICT educators, even though there are more than twice as many female teachers than male teachers engaged in school education generally, male teachers have a higher proportionate representation in the teaching of computer skills in both primary and secondary schools and Computer Studies in secondary schools.

Conclusions and recommendations

In terms of ICTs, schools in South Africa can be segmented into two groups: those with computers (3 670 or 13% of all schools) and those without computers (23 518 or 87% of all schools).

Schools without computers

A breakdown of the 23 518 schools without computers shows that they can be segmented into three clusters with a distinct range of resource endowments and capacities. These are:

- schools with better levels of resources (N = 4 939; 21% of schools with no computers; 18% of overall number of schools).[1]
- schools with minimum levels of resources (N = 10 583; 45% of schools with no computers; 39% of overall number of schools).
- schools that are highly disadvantaged in terms of resources (N = 7 996; 34% of schools with no computers; 29% of overall number of schools).

Schools with computers

The study estimates that only 13% (3 670 out of roughly 27 188) of schools in South Africa have one or more computers. A breakdown of these schools shows that they can be segmented into three clusters with a distinct range of resource endowments and capacities. These are:

- highly resourced schools (N = 477; 13% of schools with computers; 2% of overall number of schools).
- medium resourced schools (N = 1 578; 43% of schools with computers, 6% of overall number of schools).
- lower resourced schools (N = 1 614; 44% of schools with computers, 6% of overall number of schools).

Towards a national strategy for supporting ICT development in the schooling system

The following are regarded as the key implications arising out of this study for the development of policy in this area.

- The development and enhancement of ICT capability in South African schools requires a comprehensive approach that recognises the significant differences between schools and particularly the large discrepancies in the provision of ICT resources. Most importantly, however, the impact that resource levels have on use and capability in relation to ICTs must be acknowledged.
- Strategy in this area needs to take into account the likely impact if parent contributions remain key to the provision and maintenance of ICT resources.
- Despite the limitations of resource inequities, the survey has also shown that, while some schools demonstrate sophisticated use of their resources, there is a real need to increase innovation and improve integration of ICTs into the process of teaching and learning as a whole. Lack of educator capacity in this area operates as a key barrier to start-up and effective use.

With these considerations in mind, the study argues for a strategic approach to ICTs that focuses on interventions which mobilise existing resources in such a way that they are not only aimed at equitable distribution and redress, but that they also enhance what is recognised in the study as ICT 'capability'. Thus even if resources are limited, they should be mobilised in such a way that they provide the framework and foundation for a trajectory of development which will enhance ICT capability.

Key mechanisms for change

The strategic approach described above provides an umbrella for the direction that should be followed and the priorities that must be targeted

1. N = refers to the number of cases, for example, number of schools in the sample.

nationally. However, this approach needs to be operationalised by focusing on the strategies appropriate for each cluster of schools so that there is an alignment between distributive strategies and those aimed at enhancing the quality of practice. The following provides a broad overview of the central strategies proposed for 'levering' effective start-up, the equitable distribution of resources and building ICT capability.

Mobilisation: facilitating effective ICT start-up

As minimum levels of resources remain critical to developing ICT capability, attention to infrastructure development among schools must be regarded as central to ICT start-up. Given the existing resource disparities between schools and the reliance on parental contributions for non-personnel expenditure in schools, it is imperative that resource mobilisation for ICTs, especially from the private sector is appropriately targeted. From the findings of the study, it is argued that resources (infrastructure and human) necessary for ICT start-up should be directed towards those schools without computers from the 'minimum' and 'better' resourced clusters as well as the 'lower' resourced category among those schools with computers. This does not preclude attention being paid to improving the quality of provision at better-resourced schools or continuing to build a basic educational infrastructure at the most disadvantaged schools. It is rather where the strategic 'node' exists at this stage in ICT development among schools in our country.

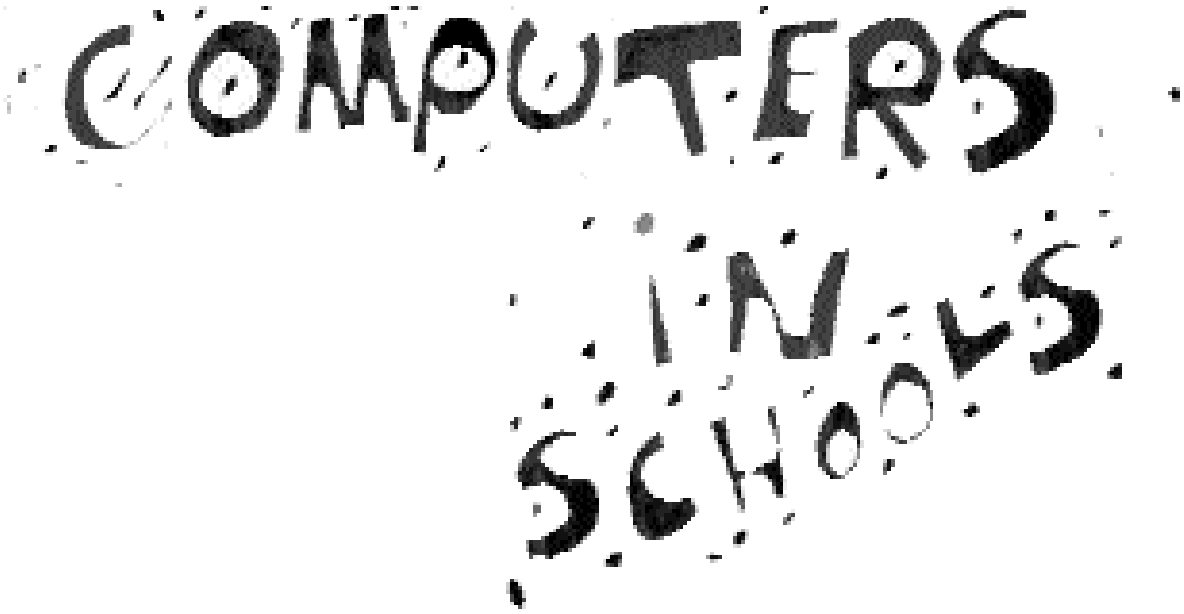
Partnerships: initiating and supporting institutional relationships

Schools with computers located in the high and medium clusters should be encouraged to promote the development of ICT capability in less well-resourced schools in their community. This could be achieved through a range of strategies including the sharing of resources, the offering of 'expert' support, the transference of skills and facilitating linkages with existing service providers. The private sector ought to be encouraged to develop appropriate partnerships with schools, NGOs and even sectors of government in the field, particularly at a provincial level. It is imperative that each stakeholder and interest group seizes the initiative to develop immediate and strategic partnerships that can sustain ICT capability.

Capacity: building human resources for ICT capability

The lack of sufficiently trained staff remains a barrier to the start-up and effective use of ICTs. This is evident throughout the profile of schools, from those that can be regarded as privileged to those that are the most significantly disadvantaged. While this is clearly a long-term responsibility of the government there is also a need for schools to be encouraged to include teacher training as a central budget item. The process of building human resource capacity also involves the development of national guidelines and criteria for the training of educators in this area and to support educators in the application of ICTs in their schools.

The primary role for the transmission and support of these strategies remains a government responsibility with other agents in the field making a secondary contribution. However, the governments' role must be informed and guided by the agents who are directly involved in the day-to-day implementation of ICT policy in schools. Particularly at a provincial level, educators, education managers and NGOs active in this area in the province are the social partners that should be centrally involved in the planning and implementation process. At every level this requires effective consultation and consensus about the strategic process that should be followed to mobilise available resources so that they are directed at the creation of equity and the enhancement of quality.



A national survey of Information Communication Technology in South African schools

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Paul Lundall and Colleen Howell
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1 Introduction

The competitiveness of any economy in the global marketplace is to a large extent determined by its effective use of information and communication technologies (ICTs). In addition, the ability of any government to effectively administer a country and deliver on its social goals is also greatly enhanced by efficient use of ICTs. Within this context, the growth of ICTs in both the developed and developing worlds has profoundly altered ways of communicating, work, space and time. Education has been seen both as a solution to preparing citizens for the information age, and as a problem in not preparing them fast enough.

The South African government, recognising the need for South Africa to participate in this 'global marketplace' and the importance of education in contributing to effective participation, has run a number of initiatives aimed at addressing concerns in this area. These have ranged from hosting a conference on the issue for developing countries, to the introduction of policies on ICT development in a range of sectors, including education.

In 1997 the National Centre for Educational Technology and Distance Education in the National Department of Education, following on from the Technology Enhanced Learning Initiative (TELI), identified the need for clear and comprehensive policies to address the development of appropriate and sustainable capacity around ICTs in the schools. This commitment was made, with a clear recognition that huge variations in access to ICTs exist which largely reflect the disparities inherited from the apartheid education system. It was also recognised that the use of ICTs in teaching and learning at present is disjointed, lacks clear direction and is highly fragmented. Although these problems were recognised, the ability to address them was severely hampered by a lack of informed and critical research in this area.

Aims of this research project

This research process began in May 1998 aiming to undertake a national survey into ICTs in South African schools. The main objective of the study was to investigate the nature and extent of ICT provision in the schooling sector. More specifically, by mapping what ICT resources are presently being used in the schools, the manner in which they are being used and the organisational arrangements used to facilitate their use, a picture emerged of ICTs in the school environment.

In addition, we aimed to identify factors that could be regarded as enabling or restricting the use of ICTs in schools. The performance of the current system and issues important to stakeholders were also evaluated and noted. This information can now be used to provide insights into policy considerations around the creation of equity, facilitating quality in the use of ICTs and identifying key areas for strategic interventions.

Participants in the research

Funding to undertake the research was received from the Canadian International

Development Research Centre (IDRC) and the research process was placed under the direction of the Education Policy Unit (EPU) at the University of the Western Cape.

In undertaking the survey the EPU also entered into collaborative relations with the Science and Technology Policy Research Centre based at the University of Cape Town, Miller Esselaar and Associates, an independent consulting agency as well as the Centre for Inter-Disciplinary Studies at the University of Stellenbosch. Collaboration was also sought to provide information about the role of NGOs and the private sector in supporting ICT development in schools.

The research team also had the opportunity to engage in rigorous discussion on the research process and methods with experienced policy makers and researchers whose mandate was to oversee the research process through regular planning meetings with the team. The core members of the team were drawn from academic institutions, the teaching field as well as from NGOs operating in the fields of information literacy and information technology.

To ensure that stakeholders were fully informed about the progress and direction of the research project, the research team also participated in a reference group constituted by key stakeholders involved in the project. The principal stakeholders were the National Centre for Educational Technology and Distance Education at the National Department of Education as the principal beneficiary of the research, and the IDRC as the principal donor.

This report thus reflects the collaborative efforts of a number of people who came together to undertake what proved to be an extremely exciting but daunting task. Although all the unique contributions may appear invisible, the report is a measure of the process of collaboration and engagement, which all contributors to the process tried to sustain to the best of their abilities.

The research process included:

- a literature survey with a particular emphasis on contextualising the study and drawing out learning experiences from other countries.
- a postal survey with two specifically designed questionnaires was sent to a sample of South African schools throughout the nine provinces.
- interviews with key stakeholders and site visits to schools in three provinces.
- a brief survey exploring the private sector's involvement in ICT provision and support for schools.
- a brief survey of NGO involvement in ICT provision and support to schools.
- a detailed analysis of data gathered from the returned questionnaires.
- the synthesis of the key findings of the survey into this final report.

ICTs: defining the concept

ICTs are the convergence of microelectronics, computers and telecommunications which make it possible for data including text, video and audio signals to be transmitted anywhere in the world where these digital signals can be received. ICTs thus incorporate a range of technologies *'used to support communication and information*'. ICTs include both networks and applications. Networks include fixed, wireless and satellite telecommunications broadcasting networks. Well-known applications are the Internet, database management systems and multi-media tools. By implication, a holistic understanding of ICTs necessarily includes consideration of telecommunications policies, information policies and human resource development policies. As Marcelle argues:

> *The ICT sector is a heterogeneous collection of industry and services activities including:*

information technology equipment and services, telecommunications equipment and services, media and broadcast, Internet service provision, libraries, commercial information providers, network-based information services, and related professional specialised services (1998:2).

Hamelink (1997) provides a useful and clear definition of ICTs indicating that ICTs are those technologies that enable the handling of information and facilitate different forms of communication. These include capturing technologies (e.g. camcorders), storage technologies (e.g. CD-Roms), processing technologies (e.g. application software), communication technologies (e.g. local area networks), and display technologies (e.g. computer monitors).

While the study has been undertaken with this broad conceptualisation of ICTs in mind, its specific focus is on the nature and use of computers.

Structure of this report

This report constitutes a detailed overview of all the key components of the study and is organised into three sections.

Section A (Chapters 2 to 5) provides a background to the study. It outlines international experience of the use of ICTs in education, and looks at factors that shape schooling in South Africa generally. This section, in Chapter 2, also provides a more detailed overview of the methodological processes followed for all aspects of the study.

Section B (Chapters 6 to 9) provides a detailed description of the survey findings. Chapter 6 deals with the findings of the questionnaires received from schools with one or more computers and the headings replicate the headings in the questionnaire. Responses received from schools with no computers are presented in Chapter 7 as they provide particular insights into issues affecting these schools. Chapters 8 and 9 describe the work being done by NGOs and the private sector respectively.

A more substantial analysis of the survey findings together with recommendations for a way forward are addressed in Section C (Chapters 10 to 13). These chapters serve to contextualise the survey results and to synthesise key findings in such a way that areas for strategic intervention are noted.

As stated earlier, this survey marks the first substantial attempt to map this aspect of education in South Africa. As such, it is primarily an exploratory study which, based on questionnaires, interviews and document research, really only provides a 'snapshot' of the terrain as it existed over the period in which the study was carried out. While it is recognised that this area is in constant flux, with new and innovative developments taking place everyday, the survey provides valuable insights into some of the key issues, both positive and negative, which characterise the development of ICTs in South African schools now and that will continue to have an impact in years to come.

2
Research methodology

Three distinct environments condition the provision and use of ICTs in South African schools. These environments are the schools sector itself, the NGO sector and the business sector. Although the state plays a prominent role in shaping policy and kick-starting provision of ICTs in schools, the main focus of this investigation is to map the school environment by collecting base-line data about the resources available and how these resources are being used in the learning and teaching process. The study also identifies the constraints that hamper the promotion and use of ICTs in South African schools.

Review of the literature

It was recognised at the beginning of the study that the use of ICTs in education has already been researched in a number of other developed and developing countries. The lessons learnt from these experiences provide valuable insights into the nature and scope of the use of ICTs in education, particularly within the framework of globalisation and the mushrooming of 'information societies'.

It was also clear at the outset that there are key issues, which have shaped schools in South Africa and which profoundly affect the use of ICTs in schools.

A thorough review of existing literature was therefore essential for developing appropriate research instruments, informing the analysis of the data and increasing the knowledge and understanding of the area by the researchers. The information and insights gained from the review were drawn on throughout the research process, and are documented in Chapters 3, 4 and 5.

Data collection in the field

The research design envisaged that data would be obtained through quantitative and qualitative methods. The design required that the quantitative data would be obtained through the submission of a postal questionnaire to schools throughout the country. Qualitative data was obtained through interviews, observations by researchers during visits to schools, NGOs and businesses as well as through an analysis of documentary sources.

Developing a questionnaire for schools

By the end of August 1998, a preliminary questionnaire had been developed for piloting purposes. The questionnaire consisted of five sections. These sections were on: school context, governance, human resources, funding and equipment and use of computers in schools.

The questionnaire was tested either with a principal, or a computer teacher/co-ordinator at twelve schools in the Cape Peninsula.

Lessons from the pilot

After testing the questionnaire, the research team met to analyse the responses obtained. The most important conceptual lesson we learnt was that the key focus of the questionnaire had to be on the collection of base-line data about actual conditions in schools.

Questions that required the filling in of fairly complicated evaluation scales were rejected or altered in line with recommendations from respondents. Other questions required reworking and simplification. These revisions were incorporated into the final questionnaire.

Rich data was obtained when the draft questionnaire was tested. It showed that there are a number of ways in which ICTs are used in the schools. In some schools computers are relatively absent from the education and learning process, but are integrated to a fairly large extent as an administrative and management tool. In other schools there have been real attempts at integrating computers into the teaching and learning process across a range of subject areas. Where the integration of computers into learning and teaching exists, it appears that computers are also being used as a managerial and administrative tool. It is interesting to note that some schools, particularly where there are few ICT resources, tend to use computers to improve the computer literacy and skills of learners and teachers rather than applying them in the curriculum. In fact, the only available computers at the school may be located within a computer lab or classroom dedicated for the teaching and learning of computing skills. There also appears to be a distinct category of schools with computers where the emphasis is placed on giving students an up-to-date education about technologically relevant aspects of computers, particularly those that impact on the computer and software industries.

Drawing up the final questionnaire

Two central issues influenced the development of the final questionnaire. Firstly there were conceptual changes in the project team's thinking about what questions needed to be answered by the research. Secondly, lessons were learnt from testing the pilot questionnaire. On the basis of the above the following were identified as critical issues in the development of the final questionnaire:

Nature of information to be elicited

The pilot questionnaire had made a clear distinction between the 'non-ICT context' and the 'ICT context'. General questions around the school's functioning were placed in the first section and questions dealing with aspects of ICT provision and use were placed in the second section. The piloting process showed that this was an unnecessary and potentially divisive distinction. Much of the information given by the respondents could not be clearly separated into the two areas of focus. It was also clear that some schools felt that the questions regarding the non-ICT context were invasive and respondents could not see their link to the stated purpose of the study. Clearly this would undermine the integrity of the study and the validity of the responses so it had to change.

It was also realised that a much clearer distinction needed to be made between the information which was needed from schools where ICTs were used and those where there were no ICTs. For example, information needed from the latter involved questions dealing with critical factors hindering or enabling the use of ICTs, whereas the information from the former group required a clearer focus on technical questions dealing with specifications of ICTs as well as questions interrogating the pedagogical impact of ICTs in the school.

In order to address these, the research team went through a rigorous exercise of interrogating each question to ascertain what information it was likely to elicit and the value of the information to the project. Through this exercise the research team arrived at the development of two separate questionnaires aimed at schools with computers and those without any computers. Both questionnaires were to be sent to each school in the sample and they would then fill in the relevant questionnaire. The development of two questionnaires was important in giving equal attention to the two groups of schools. With

the pilot questionnaire, schools without computers had felt that they could only answer a fraction of the questions and perceived their contribution to be less valuable than that elicited from schools with ICT resources.

Much work was done on making the questions and format of the questionnaire as clear and accessible as possible without losing potentially valuable information. Attention was given to uniformity in the style of the questions as well as the nature of the required response.

Attitudes to ICTs

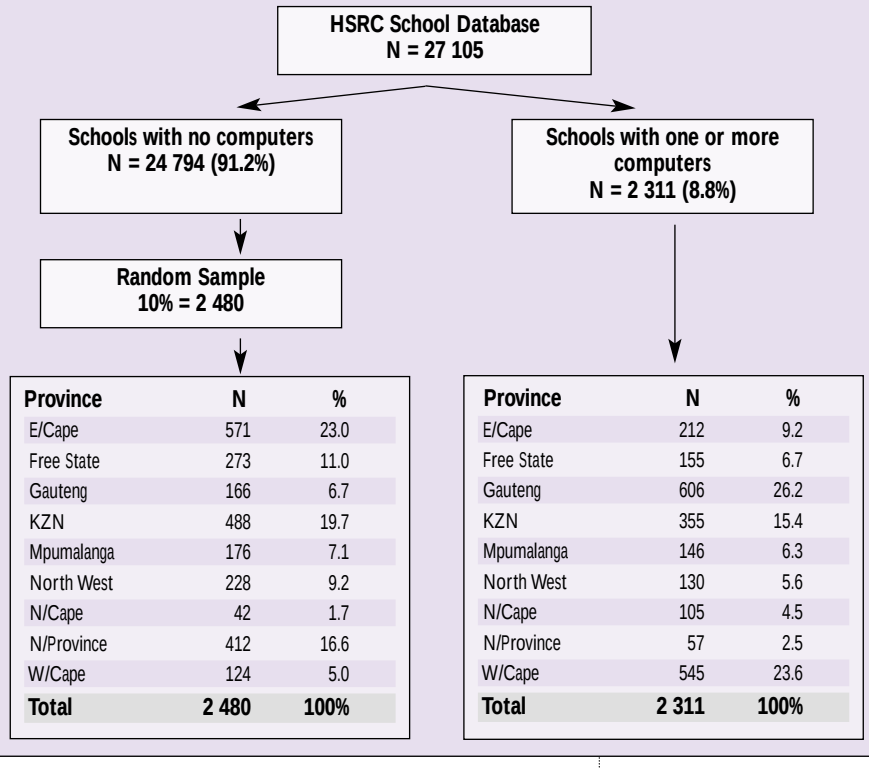
It had been recognised throughout the planning of the survey that despite the inherent limitations of a questionnaire, an attempt should be made to use this research tool as far as possible to gather information which would reflect attitudes to critical issues around ICT provision and use. In this regard the pilot questionnaire included a number of questions, which required the respondent to rank and rate their response to a question along a numerical scale.

While the value of incorporating an evaluative dimension was important, the structure of these questions in the pilot questionnaire was confusing and difficult to answer. A much clearer and more accessible format was developed which made this process easier for the respondent without losing this critical component of the survey.

Potential patterns of inequality

A review of the pilot questionnaire showed that the research team had not paid sufficient attention to including questions, which would allow us to gain insight into patterns of access and the extent to which they may be influenced by existing gender relations and inequalities in the school. Questions around various forms of access and possible patterns of inequality were thus integrated into both questionnaires.

Figure 2.1: Derivation of the sample



Province	N	%
E/Cape	571	23.0
Free State	273	11.0
Gauteng	166	6.7
KZN	488	19.7
Mpumalanga	176	7.1
North West	228	9.2
N/Cape	42	1.7
N/Province	412	16.6
W/Cape	124	5.0
Total	**2 480**	**100%**

Province	N	%
E/Cape	212	9.2
Free State	155	6.7
Gauteng	606	26.2
KZN	355	15.4
Mpumalanga	146	6.3
North West	130	5.6
N/Cape	105	4.5
N/Province	57	2.5
W/Cape	545	23.6
Total	**2 311**	**100%**

Table 2.1: Type of school in sample population

Type of school		Schools with one or more computers N = 2 311	Schools without computers N = 24 794
Primary schools	Count	1 121	16 450
	%	50.0	68.4
Combined schools	Count	361	3 150
	%	16.4	13.1
Secondary schools	Count	717	4 460
	%	32.6	18.5

Constructing a representative sample

The data in the 1996 Human Sciences Research Council (HSRC) School Register of Needs Survey constituted the population of schools around which the survey was developed. While the HSRC data was two-years-old at the time, the EPU Survey was undertaken, it was the most comprehensive and up-to-date audit of

Table 2.2: Sample realisation for schools with computers

Province	N	%
E/Cape	82	8.5
Free State	77	8.0
Gauteng	235	24.4
KZN	168	17.5
Mpumalanga	50	5.2
North West	45	4.7
N/Cape	36	3.7
N/Province	19	2.0
W/Cape	250	26.0
Total	**962**	**100%**

Table 2.3: Sample realisation for schools without computers

Province	N	%
E/Cape	41	9.2
Free State	43	9.7
Gauteng	31	7.0
KZN	96	21.6
Mpumalanga	40	9.0
North West	42	9.5
N/Cape	11	2.5
N/Province	102	23.0
W/Cape	38	8.6
Total	**444**	**100%**

existing public and private schools in South Africa that was available.

The original project proposal was to sample 10 600 schools in South Africa by means of a postal survey. Subsequently, using the HSRC data we realised that 90% of schools did not have computers at all so adhering to the original sample size of 10 600 seemed unnecessary.

On the advice of a professional statistician we began to discuss deploying a smaller sample without foregoing an adequate representation of the overall school population in the sample. A decision was made to incorporate all schools which had one or more computers into the research sample. The sample would also be made up of a randomly generated stratified profile containing 10% of all schools which did not have computers.

The HSRC data indicated that a total of 27 105 schools (public and private) existed in South Africa in 1996 providing for learners at various levels from Grades 1 to 12. The HSRC *School Register of Needs* data showed that 2 311 schools possessed at least one computer in 1996. This meant that 24 794 schools in the country were without computers. 10% of this figure (2 480 schools) formed our random sample of schools, which did not have computers. The total sample for the outgoing questionnaire therefore amounted to 4 791 schools. It was recognised that changes may have taken place in the period after the HSRC survey had been undertaken and allowance was made for this by sending each school two questionnaires. The two questionnaires were designated as Questionnaire A for schools with computers and Questionnaire B for schools without computers.

Figure 2.1 graphically illustrates the derivation of the sample for the EPU study from the HSRC database. It also provides provincial breakdowns of the sample, as it was constituted from the HSRC database for schools with computers as well as schools without computers.

In terms of the classification of schools that have been used throughout this report, three types have been identified. These are: primary schools, combined schools and secondary schools. Using this classification, the sample of schools drawn from the HSRC database contained the following distribution as is shown in Table 2.1. This information is important because it gives us a comparison and an additional mechanism by which to verify the realisation of the sample by school type, as will be shown below.

Table 2.4: Sample realisation by type of school

Type of school		Schools with one or more computers N = 962*	Schools without computers N = 444#
Primary schools	Count	457	254
	%	50.1	67.4
Combined schools	Count	147	33
	%	16.1	8.8
Secondary schools	Count	308	90
	%	33.8	23.8

*Note: * 50 of these schools did not specify a type; # 67 of these schools did not specify a type*

Sample realisation

Table 2.2 and 2.3 provide the profile of the realised sample. The realised sample needs to be compared with the sample for the distribution of questionnaires in order to ascertain the degree to which the realised sample mirrors the wider sample population.

The realised sample (N = 962) for schools with computers (Questionnaire A) constitutes 41.6% of the target population of 2 311 schools. The total number of questionnaires received

Table 2.5: Sample realisation in relation to the overall national school population

Province	Total schools 1997	Quest. submitted	Quest. submitted as % of schools	A return	B return	Total returns	Returns as % of total schools	A return as % of total schools	B return as % of total schools
E/Cape	5 880	786	13	82	41	123	2	1	1
Free State	2 881	427	15	77	43	120	4	3	1
Gauteng	2 233	784	35	235	31	266	12	11	1
KZN	5 409	870	16	168	96	264	5	3	2
Mpumalanga	1 907	294	15	50	40	90	5	3	2
N/Cape	526	147	28	36	11	47	9	7	2
N/Province	4 170	446	11	19	02	121	3	0.5	2
North West	2 412	360	15	45	42	87	4	2	2
W/Cape	1 770	677	38	250	38	288	16	14	2
Total	**27 188**	**4791**	**18**	**962**	**444**	**1 406**	**5**	**4**	**2**

back (N = 990), constitutes a rate of 42.8%. This is very 'high' for postal surveys. 28 questionnaires were returned but had too many missing responses and were subsequently not included in the data analysis. In terms of provincial breakdown and school type, a comparison between the target population and the realised sample shows that the sample is sufficiently similar in these respects compared to the target population. Further analysis shows that the proportions of school types in each province within the sample are very similar to those in the overall school population.

Against this background, and given the relatively large sample that was obtained, the sample of schools with computers can be regarded as a truly representative sample of the target population.

Table 2.3 depicts the sample realisation in terms of provincial breakdowns for schools without computers that returned Questionnaire B.

The realised sample of 444 schools that returned completed questionnaires constitutes a response rate of 17.9%. Compared to the target population of 24 794 schools, it represents only 1.8% of schools nationally. The response rate of 17.9% is low even when compared to the average obtained in most postal surveys (20–25%). The fact that the realised sample only constituted a 10% sample of the target population means that the sample that was obtained is probably too small to be regarded as representative of the specific population. This is borne out by the rather large differences – especially with regard to the provincial distribution – between the sample and the target population.

The results obtained from the realised sample of schools without computers must be treated with caution and cannot be assumed to be representative of all South African schools without computers.

Table 2.4 depicts the sample realisation by the type of school for schools with one or more computers as well as for those schools without computers. If this is compared with Table 2.1, it gives further confirmation of the close fit between the sample distribution and the sample realisation and indeed provides a further indicator that the sample is a good representation of the actual target population of schools.

Estimate of the number of schools with one or more computers

Estimates of the number of schools in the country with one or more computers can be developed from the sample of questionnaires that were initially drawn. Since two samples were initially drawn, the number of schools with computers can be calculated from each of these. This can be done using the results in Table 2.6 on page 18.

The EPU survey indicates that 837 of the schools that returned a questionnaire were initially shown in the HSRC database to have computers. In the actual return however, 47 schools from this group of 837 schools did not have a computer in 1998. This implies that the

Table 2.6: ICT characteristics of schools that returned questionnaires

	Schools with no computers (HSRC database)	Schools with one or more computers (HSRC database)	Total
Questionnaire A returned	149	790	939
Questionnaire B returned	351	47	398
Total	**500**	**837**	**1 337**

Table 2.7: Estimated growth of schools with computers: 1996–1998

Type of school	Actual profile: 96	Estimated profile: 98	Percentage growth
Primary schools	1 179	1 839	56%
Combined schools	379	591	55.9%
Secondary schools	753	1 240	64.7%
Total schools	**2 311**	**3 670**	**58.8%**

net loss of schools with computers from the overall 1996 population of 2 311 schools with computers amounted to 5.6%. If this net loss which is depicted in a highly representative sample is generalised to the overall population of schools in 1996 which had computers, the calculations show a fall from 2 311 schools to 2 181 schools.

However, the data also shows that 149 out of the 2 480 schools that were registered as not having computers in the HSRC database returned questionnaires indicating that they now have a computer. Therefore there was a net gain in the number of schools that had computers. The net gain was 149 schools with computers. As a proportion of the sample of the 2 480 schools which had no computers in 1996, the net gain in computers, as a percentage, is 6%. Since a 10% random sample of schools with no computers was initially made, we can still generalise this gain to the overall population of schools that had no computers. The calculations show a close correspondence to the results of the sample because 6% of 24 794 amounts to 1 489 schools which is almost exactly ten times more than the 149 schools shown in the survey results. The net gain in schools with computers therefore amounts to 1 489. Adding this figure (1 489) to the new sum of schools with computers (2 181), our estimates show that approximately 3 670 schools had computers at the end of 1998.

From these estimates, tentative projections on the acquisition of computers by schools that did not have them in the past can be advanced in the short to medium term.

Table 2.7 shows the estimated growth rate in the number of schools that have acquired computers between 1996 and 1998.

The growth rate of schools that have acquired computers between 1996 and 1998 averages 59% and was higher among secondary schools than primary schools. If the same growth rate is maintained over the next two years, roughly 5 835 schools will have one or more computers in South Africa by the year 2000/2001. While this rate of acquisition of computers by schools is impressive, 5 835 schools is a small part of the total number of schools in South Africa.

The interview process

Using data for Gross Geographic Product (GGP) released by the Financial and Fiscal Commission in 1998, the nine provinces were divided into three clusters representing high income, medium and low GGP provinces. One province was selected from each of the three clusters for interviews. The three provinces chosen were: Western Cape, representing the high-income provinces, Free State, a medium income province and Northern Province as an example of a low income province. A wide range of schools, representing different levels of resource endowments, were chosen for interviews.

At least 15 schools were visited in each province. All the interviews were recorded on tape. During the field trip to the Northern Province, a number of schools in Mpumalanga were also visited and interviews were conducted with school managers and ICT coordinators.

Data analysis

The analysis of the data collected through the questionnaires was captured and coded so that an initial overview of frequencies and general trends in responses could be ascertained. Cross-tabulations involving the coded data were then performed at two levels. The first level involved the selection of grouping variables and consistently using these to identify patterns and deviations for each of the items that were being tested. These comparisons were generated in tabular form and are presented in Chapters 6 and 7 of this report. The following grouping variables were selected to compare the findings and establish relationships between variables.

- Type of school (primary, secondary and combined school).
- Province (data for all nine provinces were analysed).
- Year in which school started to use computers. While Questionnaire A contained six periods to classify the beginning of this process for schools, the researchers consolidated these into three periods: the number of schools which could be classified in the first and last periods were roughly the same.
- Schools were also identified according to their geographical location. This classification identified whether schools were located in an urban, peri-urban or rural environment.
- Schools were also grouped according to whether they offered Computer Studies as a school subject or not.
- Finally, schools were classified into three categories according to the total number of computers in use. The three categories were the following: 10 and less, 11 to 29 and 30 and more. All three categories were verified as sufficiently close to the natural ranges that would have been selected statistically if this had to be done. The above range of categories however did provide a round and elegant basis with which to work.

To explore the presence of more systemic relations suggested through the data, broader categories had to be constructed. These chiefly took the form of indexes and operated on a similar basis to an index of prices (e.g. consumer price index or producer price index). A number of variables with similar or comparative attributes were merged to develop such indexes. A number of different indexes are used in the report to illuminate the association between a grouping of variables against key indicators of change. The principal indexes used are: indexes of ICT sophistication (reflecting resourcing levels in particular) and indexes of ICT application (reflecting degrees of usage in particular). The development of the specific indexes used and their relevance for the analysis of the survey are discussed in more detail in Section C.

Gathering information from the NGO environment

Various techniques were used to gather information on NGOs involved in facilitating the use of ICTs at schools. First, a list of relevant NGOs was compiled through consultation with a range of people in the field together with database scans and web searches. A questionnaire was then circulated to all NGOs identified through this process. The questionnaire included a section asking for information about other NGOs doing similar work. Most NGOs responded electronically to the questionnaire. Direct face-to-face

interviews and telephonic interviews guided by the questionnaire were also held with selected individuals. A transcript of the interview was, wherever possible, verified for factual accuracy with the relevant contact person. In addition we drew on work already done by the South African Institute for Distance Education (SAIDE) in this area.

Mapping the business environment

In order to develop a picture of the involvement of this sector in the school ICTs terrain, the following sources were used to identify a sample of suppliers of computing and communications equipment and services:

- The National Department of Education and the Western Cape and Free State Education Departments provided lists of suppliers approved for State Tender Board purposes.
- SAIDE provided names of commercial organisations that emerged in their discussions with NGOs.
- A message posted to the School.za e-mail list requesting information on suppliers to schools provided some names.
- Press clippings covering primary and secondary education over the period 1996-1999 added some contacts.
- Personal contacts in schools were asked for names of suppliers with whom they dealt.

An interview guide was created to structure the desired information from a selection of the firms identified and this was distributed by fax and e-mail. A version of the interview guide was also sent to the responsible officials in all the provincial departments to get their perspective on acquisition of facilities and services. Both interview guides are included as Appendices D & E. Where possible the researcher first made personal contact with an individual in each firm or department to explain the nature of the study and encourage them to complete the interview guide. In some cases there was a follow up interview once the guide had been completed.

Conclusion

It is important to recognise that a study of this nature is not a comprehensive national audit of the schooling sector and the impact of ICTs in this area. The study is therefore not intended to provide detailed audits of all ICT resources and their use. Rather, this study is a mapping exercise designed to inform the development of appropriate policy and intervention strategies through an analysis of data received from the sample of schools surveyed. The representative nature of the schools that participated in the survey, particularly those with computers strengthens the value that such a mapping exercise can add to detailed policy and planning.

However, since this is the first comprehensive attempt to analyse the adoption and diffusion of ICTs into South African schools, there may be a number of factors, which have either been overlooked or explored inadequately for more in-depth interventions by specific groups. These factors could have a national, regional or even a local orientation. If we are committed to expanding our knowledge and insights into this area, it will be important to address these in later studies and build on the analyses contained in this report.

3

Contextualising ICTs in education

This chapter is divided into two parts. The first part provides a broad contextualisation of ICTs in education. Part two provides an analysis of the process of policy development in the developed and developing worlds and outlines some examples of education policies on ICTs in several developed and developing countries. Policy in these examples is explored in relation to macro-level national development strategies and specific educational responses and implications.

Contextualising ICTs

The emergence of ICTs is connected to the transformation occurring in the knowledge domain and the world of production. Education is perceived to be the sphere that mediates and connects the world of knowledge with the world of work. There are two different perspectives on how countries can position education systems in relation to ICTs: one that embraces it fully and one that stresses the need for extreme caution. It is our view that the approach that should be taken in South Africa is somewhere between the two extreme positions.

The shift to knowledge economies

The convergence of telecommunications, microelectronics and computers have led to the emergence of ICTs as the primary means through which information and knowledge – the primary commodities of our time – are transmitted. The informationisation of society, a concept coined in Japan in the 1960s, has taken place and the notion of knowledge societies in which 'brain power' is seen as a prime resource is already widely accepted. Increasingly, the dominant source of trade is information. Governments, businesses, public and private sectors alike are generating revenue from the sale of information and the production of knowledge.

> *Information and knowledge are the thermonuclear competitive weapons of our time. Knowledge is more valuable and more powerful than natural resources, big factories, or fat bankrolls. In industry after industry, success comes to the companies that have the best information or wield it most effectively – not necessarily the companies with the most muscle (Stewart, 1997: ix).*

Implicit in this notion of linking information to knowledge creation is human capability. The rapidly advancing shift to knowledge economies means that resources created through 'brain power are increasingly more valuable in wealth creation than natural resources' and value is created with information. This heralds an era in which human resources are the most valued assets of the Global Information Society *(Lepani, 1996: 4)*.

ICTs are an intrinsic component of knowledge societies. They are an important part of the capacity and infrastructure that allows nations and communities to trade their knowledge and resources. The networks that ICTs have spurred, have opened up markets and contributed to an era of globalisation, associated with the concept of the information age and community. Connectivity that has

reached most countries in the world, has the potential to spread information in ways that defy national and cultural boundaries. This heralds an era in which time and space are no longer barriers to communication.

The growth of the ICT sector globally has attracted much attention from international agencies concerned with issues of universal access. In 1995, the United Nations Commission on Science and Technology for Development (UNCSTD) set up a Working Group on Information Technology and Development. The Working Group investigated the obstacles to production, access and use of ICTs in developing countries. They argued that:

> *ICTs do not offer a panacea for social and economic development. There are risks of unemployment and social and economic dislocation, and these may lead policy makers to give lower priority to the need to create effective national ICTs strategies. However, on the basis of the evidence, it is apparent that the risks of failing to participate in the ICTs revolution are enormous. Failure to give priority to ICT strategies that enable developing countries, and countries in transition, both to develop their national infrastructures and to join the Global Information Infrastructure will exacerbate the gap between rich and poor. There is a growing need to evaluate the social and economic impacts of ICTs and to create opportunities for capacity building that will ensure their beneficial use and absorption within national economies and civil society (UNCSTD: quoted in Marcelle, 1998: 1).*

On the basis of this report, Mansell & Wehn also state that:

> *Although the costs of using ICTs to build national information infrastructures which can contribute to innovative 'knowledge societies' are high, the costs of not doing so are likely to be much higher. Developing countries are at very different starting positions in the task of building innovative and distinctive 'knowledge societies' and in using their national information infrastructures to support their development objectives (Mansell & Wehn, 1998:7).*

This thinking, that the developing world has no real choice but to participate in the global information society, has informed many initiatives aimed at ensuring that developing nations participate in shaping the global information infrastructure. However, the rapid development of the ICT sector has necessitated ongoing vigilance to constantly address the interests being served by this development and to ensure that developing nations are participating in decision-making that affects them.

The effect of knowledge economies on education and learning

Against the backdrop of globalisation, the rise of knowledge economies and increasing appeals for the development of 'open societies', the demand for education is growing. Education and learning are emphasised because citizens require information competencies for the effective and efficient use of ICTs, and because innovations in the ICT sector are linked to learning. Mansell & Wehn quote Lundvall to make the point:

> *…the most fundamental resource in the modern economy is knowledge and, accordingly, …the most important process (of economic development) is learning. …learning is predominantly an interactive and, therefore, a socially embodied process which cannot be understood without taking into consideration its institutional and cultural context (Lundvall, 1992: 1; quoted in Mansell & Wehn, 1998:11).*

The link between education and economic growth places greater focus on national governments to increase levels and quality of education. There is a global trend towards 'quality education for all' coupled with encouragement of self-directed learning and shifts in approaches to teaching methodology.

The potential for the new ICTs to deliver information and education to learners across time and space alongside a growing knowledge about how learning happens, sees increasing collaboration across previous divides occurring within the educational sector. Education administrators are seeing the benefits of sharing and pooling resources to address growing educational requirements.

These trends are influencing the rise of learning societies. As information and knowledge production take on new, more dynamic forms, there is not only an increase in the volume of information, but also a greater global appreciation of the constancy of change.

In the wake of systems thinking which emphasises interconnectivity and the 'web of relations' theory *(Capra, 1982)*, we are encouraged to view knowledge as constantly unfolding. Given this dynamic view of information and knowledge, notions of life-long learning are re-enforced as people equip themselves to participate meaningfully in democracies, to exercise their human rights, to work in environments with entities and commodities which are constantly changing.

Since areas of knowledge are undergoing ongoing development, expertise has to be constantly updated.[1] And because the production of knowledge is now potentially networked, competition to remain at the cutting edge of any field presents the need to learn in an ongoing way.

These features of the global information society present the need to work with information critically, and also to work effectively with the means of communication of information and knowledge, i.e. with the new ICTs. Life-long learning has thus become coupled with the new information technologies.

Information competencies are fast becoming part of new curricula with pressure on educators to ensure that students not only have knowledge, but also the ability to learn independently. The inclusion of ICTs in learning environments serves to automate some aspects of learning and has the potential to transform the learning experience. Thus innovative educators are using ICTs not simply to create electronic textbooks and journals, but also to promote group learning, the integration of learning areas and the expansion of the learning experience as a whole. Learners are being encouraged to think critically and independently, to challenge ideas and to generate new knowledge at a much earlier age than before.

Two responses to the use of ICTs in education

The growth of ICTs in education is a global phenomenon. Countries in both the developed and developing worlds have expressed visions of participating in, and shaping, the global information society. Invariably these visions emphasise education as a primary way for ICTs to produce competent learners, suitably qualified and skilled to contribute to economic growth. In the developing world, most countries, irrespective of their economic status, feature the use of ICTs in their plans to build and sustain economic growth.

Whatever the reasons for the adoption of these strategies, there are a number of programmes underway to ensure that the developing world becomes a part of the 'global village'. For example, the African Information Society Initiative launched by the United Nations through its Economic Commission for Africa is well underway and linking with other initiatives such as the International Development Research Centre's (IDRC) Acacia programme to get Africa online. Many of these initiatives take into account the real conditions in Africa and seek to ensure that strategies for information infrastructure development articulate with these.

While these views express the notion that ICTs are a crucial feature of the present global

1. See Gibbons et al (1994) who charts the ways in which knowledge production is changing and the implications for universities. In particular, they highlight the emergence of Mode 2 knowledge characterised as trans-disciplinary, occurring in multiple sites, produced by trans-disciplinary teams in a collaborative fashion, and addressing problems in context.

condition, there is, however, sharp and profound disagreement, about how countries, individuals, and groups should respond to the spread of ICTs.

Responses to ICTs can be classified in two ways. At the one extreme, is a euphoric and visionary embrace of the potential benefits of ICTs (the optimistic view). At the other extreme, are those who oppose ICTs believing that they further divide society, exacerbate inequity, and that technology is beginning to rule people's lives and the world (the pessimistic perspective). Hamelink *(1997)* refers to these as utopian and dystopian perspectives. Most views of ICTs fall between these two extreme positions with some leaning more to one extreme than another.

The optimistic perspective derives from a number of differing and contradictory rationales. There are the 'inevitabilists' who maintain that ICTs are a fact, a way of life and that societies, countries and individuals need to be familiar with and work with ICTs in order to avoid being 'left-out'. This leads to policy choices of ensuring that developing countries catch up and are wired-up, often leading to surface change with minimal questioning of the role, nature, content, and of who should benefit from this. In education, this position translates into a call for all learners to be familiar with ICTs. Failure to achieve this is understood as leaving learners ill-equipped in a modern world. Inevitabilist discourses are rooted in technological determinism whereby technology is seen to drive changes in social arrangements. The education system is thus forced to respond to the new technologies with minimal questioning of what the appropriate forms are or what they are being used for.

Euphoric and visionary optimists maintain that ICTs positively revolutionise ways of living, communication, and working. ICTs are liberating tools that promise endless possibilities. The optimistic scenario is most prominent in the economic sphere. Here it is argued that countries that invest in ICTs will ensure that their economies are globally competitive and will increase productivity through increasing the skills, knowledge, and insights of workers. The optimistic view, believes that ICTs will increase employment and improve worker productivity.

Another variant of the optimistic version in the context of the developing world is the notion that ICTs will enable developing economies to leapfrog from industrialised to post-industrialised societies. ICTs are held up as providing a way for developing nations to overcome their dependant status in the new millennium.

Pessimistic perspectives point out the inequities that are engendered by ICTs. Such perspectives highlight the divide between the technology rich countries (the developed world) and the technology poor countries (the developing world). This view is best expressed in the following quote:

> *Africa has 12% of the world's population and only 2% of its telephone lines. Over half of all these lines are in the largest cities. There is only one telephone line for every 235 persons in sub-Saharan Africa. The costs of installing and maintaining lines are higher in Africa than in other countries, even when compared to other developing countries, and reliability of services quite poor (Marcelle, 1997: 2).*

The picture in Africa, the disparity between the richer of the developing countries and the poorer is mirrored within South Africa in the rural-urban divide. There are certainly more telephone lines in the cities, and the lack of these resources in the rural areas certainly inhibits the use of ICTs in those areas.

Hamelink *(1997)* points out that the validity of either the optimistic or the pessimistic perspective will not simply be settled by more information or research. He highlights the fact that both perspectives are underpinned by very fragile evidence. He states that the truth

of these positions is a matter of policy choice and that what is required is pro-active policies and conscious social choice which take charge of ICTs and steer a socially responsible national development agenda. The countries that succeed in meeting such challenges are able to move beyond the simple optimistic/ pessimistic dichotomy.

The development of policy for ICTs in schools

> *Increasingly all that governments and parliaments do is to react to policies that are established in the international area. It is happening in Europe, it is happening in Africa, it is happening elsewhere. The difference for Africa is that we have the least room for manoeuvre and the impacts are direct and devastating (Abugre, 1996: 22).*

Policy makers must look at the effects of policies on different sectors of the population, and not gallop into a policy just because it is the current fashion *(Ashworth, 1996: 35)*.

Various governments have produced policies that address the use of ICTs in schools. Many of these form part of over-arching policies and aim to articulate the efforts of different groupings towards development.

Policies that emanate from developed countries are generally more established and related to strategic actions with sufficient funding. While some countries in the developing world have forged partnerships that enable the implementation of such policy, these countries often face the challenge of having to finance multiple components of their policies in environments where partnerships with industry and the private sector are embryonic. In developed countries, sponsorship by the private sector is, in most cases, a well-established feature of educational development. The organs of government in these older, more established democracies also facilitate processes of policymaking, planning and implementation more easily.

Arguments have been put forward for the need for the developing world to deploy ICTs to ensure their inclusion in a global society. There is no doubt that the developing world could well find itself playing catch-up with countries that are not only strong, but that have histories of world power and domination.

In order to avoid this it is crucial that developing countries respond creatively to the challenge of ICTs. A starting point for a creative response to the ICTs challenge is the UNCSTD Working Group, which urges developing countries to prepare national ICT strategies that provide a framework for action *(IICD, 1998: Booklet 1:27 in Crede, A & Mansell R, 1998)*. Such a framework should provide guidelines that address the risks faced by developing countries, such as the exclusion of sections of the population as well as the allocation of resources, to ensure that diverse interests are served and that competing needs are acknowledged and ranked where necessary. However, Mansell & Wehn caution that:

> *For the least developed countries, the prospects for creating a comprehensive ICT strategy addressing the range of issues discussed above are extremely limited. Limitations in resources, previous experience, and existing infrastructure, combine to severely constrain the options for these countries. The challenge is to focus or 'target' strategies toward outcomes that can be affordably achieved and that will sustain movement toward fulfilling their development objectives (Mansell & Wehn, 1998: 259).*

Developing countries clearly vary in scope, levels of poverty, wealth and development. There are also vast discrepancies in levels and quality of service and access provided to ICTs and different strategies to overcome these. While partnerships between the developed and

developing worlds are strengthening, there is an imperative for the less developed countries to address the deployment of ICTs in relation to their needs and priorities lest they run the risk of blindly throwing technology at the 'gap' in development in an effort to bridge it.

In addressing the problem of service in South Africa, O'Siochru *(1996)* proposes a useful approach which impacts on the direction taken by developing countries. His approach takes account of the global dimension of telecommunications as well as the competing internal demands which developing countries need to address, i.e. those of 'a highly sophisticated first-world urban business sector (with communication needs critical to investment and economic growth) with the needs of a vast, under-served population in urban townships and rural communities, mainly without access to even basic telephone service' *(O'Siochru, 1996).* The approach includes policy formation, regulation and support. In terms of ICTs in schools, this approach could be unpacked as follows:

- **Policy formation** – to take account of the diverse needs within the nation as a whole and to target ways of addressing and prioritising competing development needs. Such policy would have to be formed in keeping with broad principles of social justice.
- **Regulation** – to effect growth within the sector along lines that promote holistic development.
- **Support** – to ensure that there is endorsement of and support for the strategic framework through a range of actions and contributions to both the policy and regulatory arenas. A national agency could provide this function of co-ordination and direction.

A further concern for developing countries would be that of integrating ICTs policy with other governmental and sectoral policies. This requires not only articulation with other policies, but also a shared vision. Such co-ordination requires the direct involvement of government and high-level endorsement by government leaders. However, this may also result in over bureaucratisation that could slow down strategic actions.

Byron and Gagliardi *(1998)* have produced an impressive study entitled, 'Communities and the Information Society: The Role of Information and Communication Technologies in Education'. They discuss policies and strategies in a number of industrialised and developing countries and present a critical discussion of key issues pertaining to ICTs in education. Hawkridge, Jaworski & McMahon (*1990*) in 'Computers in Third-World schools: examples, experiences and issues' have also made a crucial contribution.

While it is our aim to reflect on some more recent developments and discussions, it is necessary to repeat certain essentials in the debate.

Hawkridge offers four principle rationales for the use of computers in schools as follows:

- **A social rationale** – to do with the apparent importance of computers in society making their demystification at school level an imperative.
- **A vocational rationale** – concerned with the need to prepare learners for employment through providing computer competencies, including programming skills.
- **A pedagogical rationale** – operating in the belief that computers improve the delivery of education and aid the teaching and learning process.
- **A catalytic rationale** – perceives computer usage as enhancing the overall performance of schools, integrating functions of teaching and learning, management and administration *(Hawkridge, et al. 1990).*

It is important to note that in introducing

computers in schools these rationales overlap.

Hawkridge *et al's* contribution to the debate draws on the work of Duguet *(1989)* who distinguishes between restricted and comprehensive policy approaches *(Byron and Gagliardi, 1998: 11).* Duguet argues that restricted policies are designed around the social and vocational rationales while comprehensive policies (or transformative policies) engage with issues of pedagogy.

While they propose that most developed countries are moving in the direction of comprehensive policies, and that developing countries are still largely concerned with restrictive policies, it is precisely in the area of policy formation that developing countries can defy a building blocks approach to development by initially adopting more holistic approaches to their ICTs planning.

The developing world, as is evidenced by practices in South Africa and China, are basing their ICT strategies and policies upon the experiences of the developed countries and the newly industrialised nations. Their thinking is informed not only by ICTs successes and failures though, but also by their own experiences of development. For instance, in South Africa, the challenge of relating policy to planning, of developing policies which are not wish lists but which address real problems and pose real solutions, is being addressed.

Many developing countries aim to include the following features in transformative policies, making them:

- articulate across sectors.
- feasible and enabling.
- take account of real conditions that they seek to change.
- inclusive in addressing the needs of all citizens.
- gender sensitive and aware of not reproducing historic divides or introducing new ones.

The following section provides an overview of education ICTs policies in various countries. The discussion signals the ways in which countries have approached the use of ICTs in education and shows the importance they place on these developments.

Policies from more developed countries[2]

The ICTs policies in place in the UK, USA, Canada and Ireland are considered in this section. They are considered in relation to various issues in an attempt to compare approaches and insights about ICTs that would be helpful in a developing context. These are:

- What do they say and how are they framed?
- What are their strategies for realising their objectives?
- What is the articulation between policies for education and other ICT policies?
- What are the organs/structures being used to oversee implementation and monitor progress?

Do these policies display elements of Hawkridge's catalytic rationale, in other words, are these countries consciously using ICTs for changing culture and shifting practice towards integrated organisational development?

The United Kingdom (UK)

In 1998, the British Government introduced its National Grid for Learning (NGfL) initiative. This is a comprehensive strategy designed to guide Britain in its employment of digital technologies for purposes of remaining a competitive, developed country.

The NGfL, based on the Government's clear commitment to using ICTs in education, poses a comprehensive, multi-pronged strategy for the next three-year period (starting in 1998 with targets for 2002) and beyond. It is described as 'an architecture of educationally valuable content on the Internet and a

2. This chapter does not provide a comprehensive comparative review of all countries in the developed and developing worlds. Instead, it draws on a number of countries that typify key aspects of ICT policies that are of relevance to the debate in South Africa.

programme of equipping schools and other institutions with the necessary infrastructure and connectivity needed to access that content' *(UK Government Statistical Services, 1998: 3).* The NGfL incorporates the following elements:

- **Connecting to the Internet** – all schools, colleges, universities, libraries and as many community centres as possible will be brought online.
- **Professional training** – all teachers and librarians will be trained to ensure that they feel comfortable using ICTs for delivery of education and information.[3]
- **Competency in use of ICTs** – all school leavers will be assessed to ensure that they are proficient in the use of ICTs to ensure or at least improve their marketability.
- **Digital communications for administration** – aiming to reduce paper-based communications between education bodies, the government and its agencies.
- **Content development and learning service export** – developing excellence and leadership in the areas of networked content production and the export of learning services.

It is estimated that it will cost over £1 billion to finance the strategy until the end of 2002. The government, the private sector and the National Lottery are providing the funding.

It is important to note that mechanisms are in place to monitor and evaluate the impact of ICTs in education and the projects that give life to the NGfL.

The British Government has also built into the NGfL, opportunities for the public to comment on and feedback to the various initiatives underway under the auspices of this grand project. This mechanism gives everyone ways to influence policy and development. Already there has been general acclaim from the teaching profession.[4] In summing up his critical appraisal of the NGfL, Owen Lynch, Chief Executive, British Educational Communications and Technology Agency, said:

> *There is a developing quality of our Government's commitment to the use of ICTs in education. This commitment is embedded in… the quality of the Government's strategic framework, which marries the development of infrastructure, content and practice into a coherent whole. In each area there are significant targets for levels of resource, connectivity, training and usage. For the first time we have a coherent framework for both the vision and the means of making that vision a reality (Keynote Speech at North West Regional Education Conference and Exhibition, 21 October 1999).*

Already, to demonstrate progress, the Department for Education and Employment have issued statistics which show a marked improvement in ICTs provisioning in schools, teacher training, technical support since the 1998 figures *(UK Government Statistical Services, 1999).*

The NGfL approach goes hand-in-hand with a strategy by the government to adopt the new technologies in all aspects of their work so that through a 'Better Government' programme, they demonstrate effective use of ICTs. The approach is also all encompassing as it sees education delivery not only happening formally in schools but also through libraries and community centres. The 'IT for All' programme enables citizens to become familiar with the new technologies.

The emphases on staff training and development, content and multi-media production and on integrating ICTs into administrative functions suggest a fairly comprehensive policy. In addition, the over-arching framework of using ICTs to improve quality of life of citizens (providing convenient access to 'just-in-time information' and competencies) and to transform the very ways in which the society works (promoting access to government), implies that Britain is adopting an integrated approach to their use of the new

3. The East Sussex County Scheme for Computers for Schools is one example of how resources are made available to schools. In this scheme, the local authority generates funds to provide laptop computers for teachers in schools that fall under the council. The allocation of these computers is for specific areas of curriculum intervention such as Special Needs Education.

4. See responses to the NGfL at: http:/www.becta.org.uk and at 'The Grid – Your Views http://vtc.ngfl.gov.uk

technologies. Such a cohesive approach provides the framework for innovative use of ICTs as tools and catalysts of change *(cf. Hawkridge's catalytic rationale).*

The United States of America (USA)

Every classroom will be connected to the Internet by the Year 2000 and All Students will be Technologically Literate *(The Seven Priorities of the USA Department of Education, July 1997)*.

The USA is continuing to use ICTs in schools as a strategy to improve quality of education. As the Panel on Educational Technology of the President's Committee of Advisors on Science and Technology reports:

> *While a number of different approaches have been suggested for the improvement of… education in the United States, one common element of many such plans has been the more extensive and more effective utilisation of computer, networking, and other technologies in support of a broad program of systemic and curricular reform. During a period in which technology has fundamentally transformed America's offices, factories, and retail establishments, however, its impact within our nation's classrooms has generally been quite modest (March, 1997).*

The USA has the greatest levels of connectivity of all countries in the world and the highest levels of Internet use. According to the International Data Corporation, the USA is ranked number one as the nation most prepared for the information age.

The Government's plan to convert this technological infrastructure to social and economic development resides in its Educational Policy released by the Secretary of Education in 1997. Similar to the British strategy, the USA policy framework outlines areas of focus over a five-year period until 2001 *(USA Working Document, 1997).*

- Connecting schools especially in poorer areas.
- Improving student access to ICTs.
- Effective software development.
- Co-ordinating the schools effort through management of the process.
- Professional development.

The USA has also used legislation to establish a culture and practice of ICTs in Education. Among these are the 'Goals 2000: Educate America Act' which provides financial support for use of ICTs to promote school reform, and the 'Improving America's Schools Act' which emphasises professional teacher development. To date it is the most explicit and comprehensive American legislation aimed at promoting educational technology *(USA Congress, Office of Technology Assessment, 1995:6).*

Through years of experience of educational technology, the USA has come to emphasise investment not only in technology, but also in human resource development, most especially of teachers. There is growing appreciation of the fact that only through investment in teachers will investments in technology be realised.

Among its core strategies to promote the use of ICTs in schools, the USA draws on various existing funds such as the Federal Communications Commission's Universal Service Fund discounts and 'Netdays' as well as the Technology Literacy Challenge Fund. In addition, the government uses the expertise of specialist units like the National Institute on Disability and Rehabilitation Research and the Assistive Technology program to ensure that disabled learners are included in the use of ICTs in schools.

In addition, in 'The Seven Priorities of the USA Department of Education', the Government notes additional strategies for the promotion of Internet use in ways that bridge divides.

An 'E-rate' plan is being used by the Federal Communications Commissions to provide substantial discounts to 'poorer' schools and libraries for discounts on technology installations, connection charges and monthly service costs. The Federal Communications Commission ruling provides at least a 50% discount to nearly 70% of all schools, with discounts of up to 90% for schools with the largest concentrations of poor children'.

These strategies illustrate not only the USA Government's emphasis on 'connecting' the nation, but on co-ordinating different efforts and initiatives to achieve their objective of using information and knowledge to remain a world power. At the same time, their vision embraces the importance of using technology innovatively for purposes of new knowledge production. This is seen through initiatives such as the 'Technology Innovation Challenge Grants'.

These programmes encourage partnerships within the education sector between schools, colleges, universities and the private sector to promote innovative use of technologies for teaching and learning. Each Federal dollar is equaled or bettered with private or local funding.

The USA exemplifies an aggressive approach towards the use of ICTs in schools. There is substantial Congress and Federal support for the promotion of ICTs in all areas of society in efforts to remain a leader in use and levels of use of ICTs. Their growing and relatively lengthy experience in the field of ICTs means that they are certainly well positioned to embrace comprehensive approaches to ICTs deployment for the improvement of the society as a whole. In fact, even though they are a well-developed and well-resourced nation, the main contribution that the USA makes to our understanding of ICTs in education results precisely from their long innings in this field.

Ireland

The Irish Minister for Education and Science recently issued a policy framework for ICTs in education that is directly linked to economic development.

Through an Action Programme for the New Millennium, the Government intends to catch up with its European partners by promoting ICTs in schools and achieving high levels of computer literacy. Its 'Schools IT 2000' project, projected until the end of 2001 has the following goals:

- classroom resources and infrastructure,
- teacher skills development and support,
- policy and research.

As explained on the website, Schools IT 2000 is a government initiated project underpinned by substantial investment, which advances objectives and strategies for the integration of technology into schools. The major initiatives to be undertaken in this regard are: Technology Integration Initiative (TII) Teaching Skills Initiative (TSI) and School Support Initiative (SSI), incorporating the School Integration Project (SIP), and ScoilNet.

An important component of the programme is the emphasis placed on partnership. The government is hoping to attract further funding on the basis of its £40 million committed over the next two years. Already, a tele-communications company has committed £10 million over the next three years.

Strategies to integrate ICTs in education include linking all schools to the Internet over the next two year period, providing classrooms with 60 000 multimedia workstations, training teachers to ensure that they have the professional skills to use ICTs effectively, the establishment of distance learning initiatives, and the establishment of an effective infrastructure to support curriculum innovations.

It is in the area of building support for the use of ICTs in schools that the Irish experience is particularly relevant to the developing world context. The Irish place great emphasis on education and are keen to improve their ranking (at position 23, according to the

International Data Corporation) in the preparedness of countries for the information age. To achieve their goal of bringing the education sector into the information society, they are attempting to structure partnerships so that there is some means of co-ordination between different initiatives.

Firstly, in the area of content development, the government is forging partnerships with existing curriculum development structures to ensure that they bring expertise, and are influenced by ICT integration. Secondly an Industry Advisory Group has been established to help structure the partnership between education, the private sector and the public sector. This group supports and promotes investment by the ICT industry. Thirdly, the government has established a National Policy Advisory and Development Committee to help guide the implementation of its strategic framework.

Like other developed countries, the Irish emphasise staff development in addressing the problems of the 'digital divide'. They have taken measures to improve levels of universal service so that a national information infrastructure is in place for their educational objectives. While the Schools IT 2000 project makes reference to a catalytic approach to including ICTs, and while it seems that the policy is framed by the broader Information Society Steering Committee's initiatives, the framework somehow seems less evolved than those of the UK and USA. Thus while the framework is coherent in focusing on key areas of development, partnerships particularly with industry and the private sector seem to be a new area of development.

Canada

The Canadian government's ICT strategic framework is a national policy well geared towards the development of a 'knowledge-based economy'. There is no question that Canada has achieved not only the articulation of ICT policies, but also a seamless integration of ICTs into the society premised on a strong vision. Its approach to ICTs in education is based upon an understanding of the importance of building a national infrastructure that can connect various sectors (e.g. schools to other schools and libraries) as well as strong, in-depth research and development in the ICT sector. The components for a sound and meaningful approach to real development are in place. These are:

- an information infrastructure with penetration throughout society and across all divides.
- professional development programmes.
- effective, appropriate and extensive use of ICTs by the government to improve citizen access to decision-making.
- structures and mechanisms to promote ICTs such as the innovative program of 21st Century Chairs for Research Excellence, and SchoolNet Canada (see below).

Canada has a well-established education sector in which the federal Ministries of Education are co-ordinated through a Council of the Ministers of Education. In addition, teachers have an active voice in policy formation and decision-making through SchoolNet, a national structure. A well-resourced and powerful organisation, SchoolNet holds conferences and publishes on the subject of ICTs in education, indicating a strong commitment to the area. One of the debates taking place under the auspices of SchoolNet, within the Canadian Teachers' Federation, is on the value of ICTs in education. The creation of a space for this kind of discussion and interaction provides a platform for lobbying and mobilising a body of practitioners and allows them to influence policy formation. It seems that this mechanism for allowing practitioners a voice in the policy process, alongside formal representation on policy forming structures, improves participation in the issues, generates action and

gives substance to the notion of the 'knowledge society'. Canada's strategic framework is sophisticated, coherent, comprehensive and functional – they provide an example of the critical use of ICTs.

Policies in the developing world

> *Establishing the best policy framework is essential if the development potential of ICTs is to be fully realised (Crede and Mansell, 1998: 26).*

There is general consensus, among those who write about the use of ICTs in developing countries, that strategic use of the technologies has to be guided by a policy and a strategic framework. The UNCSTD Working Group is particularly adamant about this, arguing that, unless careful thinking and planning is in place, developing countries run the risk of not realising the potential of the new technologies and of misdirecting financial and other resources *(Crede and Mansell, 1998:28)*.

A much harsher view is forwarded by de Moura Castro who argues that technology investment in developing countries is already often premised on models from the developed world which are unaffordable and inappropriate *(1999:39).* Niel Postman asks: 'if technology is the solution, what is the problem and whose problem is it', and presses developing countries to answer the question: 'what are we using the new technologies for and why?' *(Moll and Froese-Germain, 1998a).*

To compound this issue, a major problem for developing countries is that of developing strategies that are financially, and in all other respects, sustainable. In other words when developing countries incur debts in building expensive information highways, this is not a once-off cost. These infrastructures and systems have to be maintained and upgraded to remain viable. This is obviously a critical issue in sustaining ICTs development in schools.

It seems sensible for developing countries to use ICTs in ways that are going to make a difference to their economies and the quality of life of their citizens. It is important for developing countries to address the reasons they are adopting the new technologies so that there is clarity of purpose and an agenda that makes sense within their own specific context. However, it is important too that developing countries have the same space for experimentation and innovation that the adoption of any new intervention requires.[5] It is only in this way that developing countries will be able to 'make ICTs their own'.

An enormous stumbling block in the use of ICTs faced by all developing countries is the low levels of basic literacy. This very basic problem, when looked at together with the demands of the business sectors in these countries, means that strategies have to take account of very different, and often competing, social sectors. Governments often have to deal with the impoverished conditions of the vast majority of their citizens as well as the urgent business requirements of a small sector of their populations. Because the latter often generate wealth in a more direct way, it is tempting for governments to prioritise their demands over and above those of the majority.

This raises the crucial question of the economic development strategy pursued by governments. It may be argued for instance that investing in technology to generate economic growth would provide the substantial resources needed for effective delivery of basic social services and goods. It could also be argued that investment in and provision of social goods is a key aspect of improved productivity and growth. The approach of most governments to these two positions has been to settle for a delicate middle path focusing on both social service investment and technology investment for business growth.

Irrespective of how persuasive the logic of educational investment in ICTs might be, most

5. Michael Dertouzos argues the following essentials for innovation: 'four ingredients – risk-aware capital, a high-tech infrastructure, a creative idea that serves a pressing human need, and a passion-oriented entrepreneurial culture – are rare. It's even rarer for them all to come together in a startup. Perhaps that's why so few succeed. But when they do, the rewards are ample'.

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governments in the developing world have to address the competing claims made on budgets by different sectors. To what extent can governments justify investment in ICTs for education in the face of demands for improved health, proper shelter, and urban and rural development?

In African contexts, it is important to note the schooling conditions that prevail. A 1997 United Nations Educational, Scientific, and Cultural Organisation (UNESCO) report indicates only 39% of girls and 50,4% boys were at school in 1992. Figures for Sub-Saharan Africa are even more dismal: 20,3% girls and 25,9% boys. Furthermore, highly impoverished conditions in most African countries mean that school buildings, sanitation, water, electricity supplies and other basic resources are often in poor supply. It is against this backdrop that campaigns to build the information infrastructure in Africa and to use ICTs for purposes of development must be viewed.

The 1996 Information Society and Development (ISAD) conference, recognised these very real disparities and challenges with which global society has to contend. They called for co-ordinated action to promote the use of ICTs in the interests of bridging the 'gap' between the developed and developing worlds *(ISAD Conference, 1996)*.

To help developing countries which do not yet have ICT policies in place think through the issues, the UNCSTD Working Group have listed with the following areas of concern. *(UNCSTD Working Group Report, in Mansell & Wehn, 1998: 266-270)*.

- Producing and using ICTs to social and economic advantage – Policy is required to reduce the potential of ICTs to widen existing social divisions or introduce new ones and to create economic and social benefits for all.
- Developing human resources for effective use of ICT. People are the primary resource in the information age. Policy must ensure that people have the skills to work effectively with the new technologies and that these skills can be constantly updated in accordance with changes in the technology.
- Accessing networks. To avoid exclusion of any players, policies around national information infrastructure must allow for growth and upgrading as well as integration with the global information infrastructure.
- Promoting and financing investment in ICTs. Governments must have policies that enable them to actively pursue successful ways of securing ongoing investment in the ICT sector. This cannot be left to market mechanisms, especially in countries that are unattractive to investors.
- Creating and accessing scientific and technical knowledge. Policies that promote the production of scientific knowledge and that bring countries into the global society must be advanced.
- Monitoring and influencing the 'rules of the game' – governments must ensure that they participate in creating the 'rules of the game' such as setting standards and policies around intellectual property rights, regulation and trade.

These guidelines deal with areas that any developing country must address in the production of their strategic frameworks. The considerations apply as much for ICTs in education as they do for national ICT strategies. There are other concerns though for countries in transition in their approaches to adopting ICT strategies for development. There are issues of: mobilising resources both within countries and from donor communities; adjusting decision-making processes to facilitate efficient, decentralised structures that allow for participatory planning procedures; integrating policies on ICTs with overarching economic development strategies; indigenous

capability development to bolster national production of, and proficiency in, various aspects of the infra- and infostructures.

The following examples of ways in which developing countries are addressing ICTs provide a glimpse of the kinds of issues which are pressing at this time.

China

China emphasises its use of ICTs for purposes of development. Its educational network, 'China Education and Research Network' (CERNET), was formed in 1993 and plans to link all components of the education sector to the Internet. The network is funded by the government and managed by the Ministry of Education. CERNET will link all universities putting in place a national infrastructure which all schools (high, middle and primary) will also join.

China's education policy on ICTs is not yet evident, there is no doubt that the government is keen to use ICTs for development and that through CERNET, it is signaling a strong link between education, research and economic development.

Covering 9.6 million square kilometers and with a population of 1.2 billion, China has 30 provinces, 517 cities and 1,075 universities and institutes, more than 39,412 middle schools with 55 million students and 160,000 primary schools with 122 million pupils.

To direct their efforts most efficiently, China has recently merged a number of Ministries (Electronics Industries and Posts and Telecommunications with parts of Broadcasting, Film and Television) to forge the new Ministry of Information Industries *(Bohlin, et.al: 1999)*. Over the last decade China has also seen significant growth in universal access. Between 1988 and 1994 telephones in urban areas increased by 207% and in rural areas by 193% *(Mansell & Wehn, 1998: 160)*. However, despite enormous investment by government and the ability to attract global funding, it seems that China faces the problem of 'growing dualism' between urban and rural. Despite the growth in the number of telephones indicated, in 1994 there were 6,74 telephones per 100 inhabitants in urban areas whereas in rural areas there were only 0,67.

India

India's government aims to make the country an 'IT super-power' by the year 2008. It has put in place a National Task Force on Information Technology and Software Development. The Task Force has emphasised information and knowledge as strategic resources and aims to improve the country's information infra-structure to provide access to the Internet. The government is intending to provide hardware to high schools (of which there are about 100 000) and colleges on a grand scale with the idea of linking these to the national information infrastructure (*Bohlin, et al. 1999)*. Implicit in this move is the appreciation of the centrality of education to information society development, a lesson also learnt through India's involvement in software development.

India has become one of the leading software producers in the developing world. It is using ICTs innovatively in this area by encouraging software companies to locate in a rural area of one of its states in an effort to decongest the cities *(Bohlin, et al. 1999)*. At present, India is training over 55 000 IT professionals a year and the government has introduced new courses (in areas of computer application and computer engineering) to address this area of growth *(Mansell & Wehn, 1998:139)*.

India provides the international software companies with access to cheap labour, and round-the-clock service. This has had a positive impact on the Indian economy, generating a larger focus of resources on the ICT sector and this has implications for the integration of ICTs in education. But the experience has also revealed infrastructural and cultural challenges that developing countries have to contend with in software production. Mansell & Wehn *(1998:*

140) site some of the barriers to entering the higher value software markets as follows:

- lack of experience in broad software development,
- unreliability of India's own ICTs infrastructure,
- lack of trust based on cultural difference.

India's experiences highlight the difficulties developing countries face when entering markets still dominated by global superpowers. They signal the importance of: developing an experience base to become a global player; the need to develop indigenous capability so that efforts are not geared only towards export but focus on local requirements and priorities; the need to appreciate the less tangible realm of cultural diversity and its implications in entering global partnerships and markets.

India's experience also highlights the issue of quality of infrastructural development. Connectivity in the developed world does not necessarily mean the same thing as connectivity in the developing world. Both India and China for instance operate largely on 64 Kbps satellite or fibre optic links. 2Mb pipes are rare and celebrated. In the USA, the average connection is a 16Mb fibre optic cable. The discrepancies in the amount of information and the speed at which this information can be transmitted are vast. The discrepancy also probably indicates a predominance of particular kinds of content transmitted from the developed world across the information highway.

These experiences notwithstanding, one of India's states – Andhra Pradesh – with a population of 75 million, has opted for extensive investment in the full integration of ICTs into all aspects of governance and life. Thus the government itself will use ICTs, and ICTs will be integrated into the education, banking and commercial sectors and will be used for the delivery of preventative primary health care *(Bohlin, et al. 1999).*

Malaysia

Malaysia, a fast growing economy in the East, strongly emphasises the development of ICTs. Information technology and literacy is seen to be inextricably linked to economic development and the stated strategy for growth and progress as identified in the Seventh Malaysia Plan *(1996 – 2001).*

The promotion and advocacy of information technology and literacy is not only part of a centrally initiated and co-ordinated strategy; the President himself spearheads it. Information literacy is seen as part of a process of modernisation and economic development. The spread and increased use of appropriate information technologies is perceived to be central to the project of catapulting Malaysian society into the 21st century. Allied to the modernisation project is the growing assumption that technological familiarity and competence amongst all Malaysians is central to the continued economic development of the country and vital in ensuring that Malaysia develops as the economic power-house in the East.

Higher education institutions are setting up programmes and short in-service courses that develop information literacy skills. One example of this is the Masters in Education (M.Ed) in Information Technology offered by the Faculty of Education, University of Malaya. It is envisaged that soon all university students will take an information technology foundation course related to their field of study.

Information literacy is identified with the moves to refocus teaching and learning away from teacher-dominated instructional settings towards more learner-centred and resource-based education. The discourse of learner-centred education is premised on the grounds that new information technologies generate multiple sources of informational resources that cannot be 'taught' in the conventional lecture-student relationship. Instead, it is argued that learning, particularly in higher

education, should provide students with generic competencies and skills that enable them to become effective information-seekers and critical users. Such an approach to learning, it is believed, necessitates greater collaboration between academics, librarians and other persons involved in education.

The creation of a Division of Information Technology in the Ministry of Education enables educators to implement awareness and appropriate information technology programmes and projects in schools. The Education Ministry, in collaboration with the government and within the framework of Malaysia's plan for growth and development for the 21st century, has embarked on a programme to integrate information technology into education at a primary and secondary level. Throughout the programmes, rural schools have been prioritised to ensure their inclusion in the development process.

Furthermore, collaboration is perceived as vital to the successful institutionalisation of information literacy projects and programmes. Forms of collaboration include a range of networks that exist between academics, information specialists, government departments and the business sector.

Conclusion

This chapter has argued that the issue of ICTs in education must be seen in the context of global transformation in knowledge production. It is inappropriate to embrace ICTs uncritically or to deny their value. The starting point of an effective ICT policy is a clear understanding and comprehensive audit of needs and requirements plus effective mechanisms of policy delivery. While many countries are strong on visionary policy statements regarding ICTs in education, there is often little attention to the development of strategic delivery plans. Moreover, given the fast changing nature of ICTs, planners require rapid, flexible, and responsive policy formulation and delivery mechanisms and structures.

4

Issues arising from the application of ICTs in education

The previous chapter looked at goals and visions contained in policies on ICTs, but little was said about how ICTs are being used in schools both locally and internationally at this time. This chapter reviews the literature in terms of issues that the use of ICTs raises in schools. The main issues are:

- Are ICTs being used in teaching and learning? Are they simply tools for drill and practice or are more innovative uses evident?
- Are ICTs being used for management and administration and to transform relations and roles in the schools context?
- What investment is being made in teachers and other staff necessary to support ICTs?
- Given the massive costs of ICTs, are monies wisely spent on ICTs?
- In what ways are ICTs being used to bridge or widen gaps or create new ones?
- To what extent is the area of ICTs in education being developed as an area of research in which knowledge can be shared?

ICTs in teaching

In a context of massive global transformation, in which the education sector is experiencing its fair-share of the pressures of change, it is not uncommon for educational technology to be viewed as a solution to crises in education *(Moll & Froese-Germain, 1998a)*. It is therefore important, especially in the context of developing countries, to view the opportunities presented by ICTs in education against the backdrop of all the challenges faced by education systems, particularly in view of shrinking resources.

> *'Technology is only a tool. Educational choices have to be made first in terms of objectives, methodologies, and roles of teachers and students before decisions on the appropriate technologies can be made. No technology can fix bad educational philosophy and practice. The challenge is to rethink learning objectives and to align the learning technologies with these objectives' (Haddad, 1999:1).*

ICTs are being used in a variety of ways to engage with teaching and learning. Traditionally technology is used to promote 'drill and practice' type exercises; to teach technology itself, to introduce new subjects like computer studies; to teach basic computer skills like word-processing. More recently, technology has been used to promote student-centred learning through a greater emphasis on project and teamwork. In the latter approach, ICTs become integrated into the curriculum so that students acquire new communication skills at the same time as learning about a knowledge domain.

While this approach comes closer to engaging learners in ways that deepen their learning experience it is teacher-intensive in the levels of input and facilitation required *(Alexander, 1999: 9)*. It is important to recognise that student-centred learning does not alleviate teacher workloads. Teachers are still responsible for designing learning programmes that deliver content and

enable the acquisition of competencies and in addition their role expands to include facilitation, guidance and the instilling of awareness in students of their own learning patterns.

Basic, generic information skills courses

UNESCO endorses the use of ICTs in education and is committed to helping developing countries achieve this *(Johansen, 1999: 55)*. Of some concern in their approach is the promotion of a 'Basic Foundations in Informatics' course *(1997:19)*. While there clearly is a demand for learners to acquire basic information skills, there is a debate about how best learners acquire and retain such competencies.

Recent studies on information literacy have raised concerns about the value of generic courses in promoting information skills without their bearing to a knowledge base or subject area. While generic competencies may be taught, it seems that in order for learners to internalise these, they must have meaning in relation to a particular learning problem. These studies suggest that ideally, learners should acquire information skills in relation to content and that the kinds of skills learnt may well vary across disciplines and contexts. It seems that generic courses such as the ones proposed by UNESCO assume transferability of skills acquired. Limited evidence suggests that information competencies have to be reinforced at all levels of learning due to the contextual nature of learning. In other words, the development of generic skills is intimately connected to exposure to ICTs and the application of those skills.

Issues of content and materials development

The integration of ICTs into learning areas raises the issue of content and materials development. Who is producing this content, which messages are being transmitted and how costly and time-consuming is it to generate software? These questions have to do with issues of relevance for local contexts and the domination of particular kinds of knowledge. The development of materials is clearly an area that requires additional skills for teachers. However, as is noted in the quote below, ICTs may highlight the lack of indigenous content, but these problems are not necessarily new:

> *'Educational software, sometimes, is referred to as if it were an additional teaching and learning resource that differs in format, but not in kind, from the non-electronic materials of textbooks and the like. It can be just this. Increasingly, however, it is something radically different – through using the World Wide Web, Intranets and networks – to create interactive, individualised learning situations. And, some of the important uses of ICTs in schools do not use educational software as such at all – whether networking between students and teachers using e-mail or bulletin boards or different forms of document formatting and publishing applications. We need to be sensitive to this diversity of forms and use, which give rise to increasingly complex issues concerning quality, partnerships and policy steering (Alexander, 1999: 8).*

It is important to recognise that the technology sometimes presents old problems in new guises and sometimes presents new opportunities that cannot be easily seized because they are seen in traditional ways.

In response to the need for indigenous content, many developing countries are emphasising content development, digitisation of their archives and use of ICTs to promote their national heritage. It seems that such developments are an important, often costly, yet important and intrinsic part of building national information infrastructures. However, the additional communication opportunities presented by ICTs referred to by Alexander suggest firstly that content development is part

of a process, not an end in itself, and secondly, that the area of educational collaboration presents a new set of concerns which educationalists and learners are encountering more and more as these features of the technology are being used.

Integrating ICTs into curricula

The content/learning/technology dilemma is one that reinforces the complexity of the teaching process. In the experiences of the US-based Institute for Research on Learning *(Goldman, et al. 1999)* the following are helpful ways to create a healthy balance in integrating ICTs in education:

- Ensure that learners are dealing with real-world problems and that their projects are as realistic as possible – it seems that when learners are designing a project for the public domain, they assume responsibilities that accompany authorship.
- Ensure that there is sufficient time for playing with the technology as part of the learning experience – due to pressure on scarce resources, it seems that learners often compromise learning for the sake of completion of their projects.
- Ensure that students have the necessary skills that allow them to use the information to which they have access efficiently and effectively – while learners register a need for more information to improve the quality of their projects, they aren't always competent to use information resources proficiently whether online, computer-based or hardcopy.
- Ensure that learners are involved in decision-making – it appears that as learners take greater control of directing and leading their projects as part of teams, they take greater responsibility for driving the project and pushing the limits of the technology to get it to perform to their requirements rather than conforming to its capacities.
- Ensure that there is systematic assessment throughout the project – in so far as possible, learners should be evaluating their work themselves and monitoring their creations and development against agreed criteria.
- Ensure that teachers are helping learners become conscious of the content they are learning – learners can register excitement about the technology or their authorship and yet remain unaware of what they have learnt about a particular topic.

These experiences are based on the application of ICTs to learning contexts in which teachers were particularly concerned with using ICTs creatively to impart their subject knowledge. The emphasis was on learning the content rather than the technology, although it was found that the technological dimension added an element of pleasure for learners.

In response to needs expressed by teachers to integrate ICTs into curricula, the USA Education Department has produced an online resource entitled: 'Educator's Guide to Evaluating the Use of Technology in Schools and Classrooms'. This tool helps teachers deal not only with issues to consider in ICTs integration, but also with how to build monitoring mechanisms into their design. It is produced in manual form in relation to many real questions teachers ask in relation to ICTs and as such, has proved a valuable resource with appeal also to developing contexts.

In response to broader issues of ICTs in education, the GINIE (Global Information Networks in Education) project (www.ginie.org) is a web-based resource that is designed, according to its director, 'specifically for developing countries in times of educational crisis' *(McClure, 1999:57)*. This tool is geared towards education professionals and provides information to train teachers and assist in the development of policies for using ICTs.

Free educational materials are provided and teachers are encouraged to post their own productions to the site. Emphasis is placed on networking professionals and policy-makers in the belief that such communications will overcome lack of support that people in developing countries may experience.

ICTs and learning

A primary question being asked is whether ICTs impact positively on learning. In order to address this question, it seems important to clarify what 'learning' means. As Heinecke, et al. argue,

> *'If one defines student learning as the retention of basic skills and content information as reflected on norm referenced and criterion referenced standardised tests, then, evidence suggests, there is a positive relationship between certain types of technology and test results. For instance, it is well established that if a teacher uses computer-assisted instruction or computer based learning approaches, where the computer is used to manage the 'drill and skill' approach to teaching and learning, students will show gains on standardised test scores. This view of technology reduces the equation to only a student, a computer and a test. It ignores the effects of schools, teachers, and family and community life on the learning process. Even though we cannot control for these variables, we must not discount them. If, on the other hand, one views the goal of education as the production of students who can engage in critical, higher order, problem-based inquiry, new potential for entirely different uses of technology emerge' (Heinecke, et al. 1999).*

Looking at ICTs and learning suggests that a new understanding of what learners ought to be doing and acquiring through their schooling should be reached. That is, new learning outcomes that prepare students for active participation in the information age and in building knowledge economies are essential. This argument underscores global shifts towards outcomes-based education, although it also suggests that public education 'creates' citizens who can undertake specific economic and social functions dictated by the needs of commerce and industry *(Moll & Froese-Germain, 1998a)*.

While this debate is not being revisited here, it is important to note that broader notions of what education ought to be about inform any discussion of ICTs and learning. Definitions are therefore context-dependent, historically determined and fluid. However, given the tremendous impetus towards student-centred, outcomes-based education, questions regarding the impact of ICTs on teaching and learning are pertinent. It is interesting to note as stated above that while ICTs are geared towards independent, self-directed learning, teachers must invest significant time in designing and directing learning programmes that guide and monitor learning.

Recent studies of impromptu learning in India suggest that students engage with the new technologies in ways that present new insights into group and dynamic learning *(Papyrus News: 1999)*. Educators from the Cognitive Engineering Research Centre of a leading Indian computer education firm used a 'minimally invasive' approach to introduce mainly non-school going children to technology.

Their findings showed that without any instruction, the children discovered and used different features of the technology (both the hardware and software), started teaching each other, developed their own vocabulary to explain the computer functions, did some drawing and surfing on the web. The children identified the need to find themselves a teacher – a second year Bachelor of Arts distance education student who has taken a basic course in computers – to accelerate their learning.

The researchers undertook the experiment in response to academic concerns that the Internet is not of value to the region and that too much investment in training would be

required. Although generalisations cannot be made from the study, the researchers argue that the exercise shows that uneducated children can teach themselves about computer and Internet usage at least to some extent. They suggest that through introducing more kiosks of this nature, poor children with access to the Internet will generate their own demands for and uses of these facilities. They plan further such experiments in the hope that through the children's enthusiasm, communities will start using the Internet for their own purposes.

On the issue of cost, the researchers point out that India is the largest film producing country with many citizens patronising cinemas despite their poverty. They suggest that once communities have experienced the benefits of Internet access, citizens would patronise this industry too.

While experiments of this nature do not provide conclusive evidence of the relation between ICTs and self-directed learning, they certainly illustrate the possibilities for younger generations of learners to use new technologies to access learning. Even though no comment can be made on the kind of learning, or on the value of ICTs to their experiences, it seems that ICTs added pleasure to the learning experiences of these children. Experiments such as these also suggest useful ways of addressing the digital divide evident within developing countries by ensuring that poor communities not only acquire the skills, but also access the resources that allow them to at least feature in the information society.

Experiments of this kind suggest that computers can be introduced into impoverished environments through initiatives like community learning centres with a measure of 'minimum intervention' at least at the level of instruction. It seems that a degree of self-learning is possible with access to computers and to ICTs. The introduction of these kinds of centres may lessen the burden on schools as the first point of contact with ICTs, to spend lots of time on induction and familiarity type exercises. They may mean that learners coming into school with some degree of familiarity could move more speedily to integrated learning contexts in which ICTs are used to acquire content and knowledge.

This in itself raises questions about how levels of preparedness are gauged and whether some learners may require extra tuition to allow them more advanced and efficient use of ICTs. It seems though that a strict building blocks approach to the acquisition of a range of information competencies may be inappropriate and that learners acquire skills and know-how on the basis of interest and need. Thus if learners are required to perform advanced functions and allowed time to experiment, with minimal instruction, they may retain these competencies on the basis of their need to know, and their application of information competencies to real problems.

However, despite these inputs, there are diverse opinions about the value that ICTs add to learning. On the one hand, there is a view that there is insufficient evidence to prove that ICTs improve the educational experience *(Moll & Froese-Germain: 1998c; Jurich, 1999)*. This view states that it is also dangerous to generalise from one or two success stories.

On the other hand, there are those who argue that in order to do justice to the question, new approaches to research that take account of uncontrollable variables that influence learning must be developed. Not only that ICTs add value in the classroom, but also that the technologies themselves can be used to conduct and report on evaluations. Based on work at the National Centre for Research on Evaluation, Standards and Student Testing, when a full range of questions are asked, there is no doubt that ICTs have a positive effect on learning.

While these polarised views cannot be resolved here, it is important to note that just

as information is not neutral, neither are ICTs, the contexts in which they operate nor the purposes for which they are used. Similarly, evaluating their impact is not a neutral process and is always informed by why the evaluation is taking place, by whom and for what purpose.

In an attempt to understand the impact of educational technology, Jurich *(1999)* summarises four research reports written during 1993 and 1999. Each signals that their studies are context specific and that their findings may not be generalisable. To illustrate the contextual nature of studies and the nature of research in this area, three of the studies tested for gender-related discrepancies in the use of computers in schools yielding different results – some show a positive relationship between girls and computers and others the reverse. What the studies seem to agree upon is the degree of difference that positive teacher involvement made to the use of ICTs in schools. The studies also suggest a positive relationship between computer use and student achievement, especially for those students most in need (poorer, disadvantaged students).

They also indicate that when teachers and learners have easy access to computers, i.e. when they are based in the classrooms rather than in laboratories, effective use and good experiences result. What Jurich proposes is that improved test scores tell us very little about other factors that are changing with the introduction of computers and that these may well positively influence educational achievement even without the introduction of computers. For example, professional development and community involvement and support are influences that could greatly enhance any educational context.

Honey *et al.* drew on a number of authors to argue that:

> *In order to be effective, innovative and robust technological resources must be used to support systematic changes in educational environments that take into account simultaneous changes in administrative procedures, curriculum, time and space constraints, school-community relationships, and a range of other logistical and social factors (1999).*

These statements all indicate that it is important to accept that a wide range of factors influence effective ICT use. Curriculum design, classroom organisation, time allocation, social setting and culture all influence the ways in which ICTs are used and perceived in schools. It is almost impossible to undertake studies to test for improvement without engaging with these dynamics. In fact, they argue that in order for technology to make a meaningful impact on learning, it has to be introduced alongside other kinds of change. These are:

- instructional leadership
- effective school improvement teams
- extensive professional development in whole-language teaching approaches and co-operative learning
- a strong emphasis on student creativity and the expression of ideas in multiple formats
- an emphasis on providing different points of entry into a task for children working at different ability levels
- a de-emphasis on remediation and an emphasis on learning for all
- establishment of classroom libraries and media-rich classroom environments
- a multi-text approach to learning that includes the integration of technology into instruction *(Honey et al. 1999)*.

Introducing ICTs requires attention to many other areas so that a holistic approach to educational change is developed. Regarding the system as a whole even at a school level would help administrators identify why they are making changes, what these are, what the new system will look like and how it will function

effectively. The introduction of ICTs in such a context allows these changes to be part of global, school-wide changes, not simply fashionable add-ons which throw technology at students in an attempt to solve educational crises and poor performance.

More recent developments surrounding the notion of information literacy *(Candy, 1996)* are also useful in understanding the relationship between ICTs and learning. The literature suggests that the use of technology cannot be divorced from processes relating to the critical evaluation of information skills that are both generic and subject/context specific. In other words, the impact of ICTs on learning is connected to the extent to which learners become critical evaluators of information to solve problems and develop new insights and understanding.

ICTs as administrative and management tools

An additional dimension of ICTs usage in schools is for educational management. Computers fulfill 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 day-to-day basis. Removing the tediousness, drudgery, and time-consuming nature of such administrative processes, computers allow for the effective use of educators' time in more creative and productive ways *(Crawford,1997)*. For example, some teachers use computers to monitor learner progress through constructing student profiles *(USA Congress Office of Technology Assessment, 1995)*.

Effective use of computers for proper administrative procedures also offers possibilities for some degree of cost saving. For example, communicating with staff through e-mail saves on photocopying costs.

However, it is important to note that computer technology is not a substitute for poor or non-existant administrative systems. With or without computer technology, badly managed schools will remain so. It is only through careful and properly planned usage, that computer technology can free time for more creative work. Once again, an integrated and comprehensive approach to using ICTs for administration and management is required.

Staff needs and teacher training

The UNCSTD Working Group places great emphasis on human resource development. The information age has created a range of educational and social requirements to sustain itself. Teachers are now expected to perform a range of new functions in order to produce a well-educated layer of confident young people who can generate revenue for their countries in a host of new ways.

While ICTs present many exciting opportunities for teachers, there is no doubt that the current pace of change causes great pressure. It is important that policy-makers and planners take account of this and that the following key resources are put in place in schools.

Technical support

Information infrastructures require constant maintenance and frequent upgrading. Technical staff that 'look after' the ICTs including the workstations and fileservers, require an understanding of the hardware and software they are installing, and also of the ways in which the technology is going to be used in the short to medium term.

They need to know whether certain applications or software will run on a school's system. They should be able to advise on optimal use of a network and sensible upgrades for long-term planning. It is clear that these

functions are vast and could be extended to include user and network administrator functions such as the creation of user identities (login names and e-mail addresses), advising on licensing agreements, etc.

To address these very real service requirements, schools need to decide whether to:

- outsource some of the work.
- share certain staff with other schools in their area.
- combine certain roles, e.g. technical support staff could also perform a training or user-support function.

It is crucial for management in schools to recognise that the best plans come undone if there is lack of articulation between 'technical' and 'educational' functions. Cost considerations should include the fact that technical staff have to upgrade their skills fairly often and this can be expensive.

Advisors

Teachers need support to help them work through issues of design and delivery of curricula and programmes. The demands of determining what students need to know and be able to do on completion of their studies and translating this into curricula and activities is something in which teachers ought to be trained. However, integrating ICTs into curricula in ways that develop content as well as information and research skills that expand the brief of teachers beyond that of a conveyor of subject knowledge.

Teachers often don't know what they can do with technology and the tendency is to use ICTs simply to automate traditional teaching methods which is why drill and practice is usually the first form of implementation. The need for advisors who can provide support and a resource base to guide teachers is critical. Advisors can also facilitate group work among teachers so that there is a sharing of experience and hopefully collaboration around projects. In many schools this advisor role is simply allocated to a teacher as an additional responsibility, and advisors are not trained for the task they need to perform. Increasingly, at least in the developed world, this support function is being acknowledged as crucial to the effective use of ICTs. In the UK support teams, which include advisors, have been put in place to help heads of ICTs at schools develop their plans for implementation, teacher support and development *(cf. 5.1)*. Through the Office of Technology, the USA has also identified ways of increasing support for teachers keen to use ICTs by:

> *Training master teachers, who then serve as resources for their colleagues, and providing expert resource people from other staff, such as librarians, computer coordinators, or volunteers from business, parent, and student groups (1995: 28).*

However, in reality these 'experts' or advisors are absent in most school settings and often where they are found, the support persons tend to supervise students rather than support teachers *(USA Congress Office of Technology Assessment, 1995: 129).*

Teacher training

It seems that many countries start using ICTs in very rudimentary ways so that 'drill and practice' type activities feature commonly. The reason for this is that there is a 'development' period during which teachers and students become familiar with the technology. As Goldman *et al.* explain:

> *In case after case we see that when computer technologies are adopted, the learning about the technology often takes over, and it is only after several rounds of integrating technology with content that content emerges in strong ways. The technology learning curve tends to eclipse content learning temporarily – both kids and teachers seem to orient to technology until they become comfortable (1999).*

It seems that this factor, is one around which administrators can plan. Since there is a strong indication that familiarity with technology is an area that requires attention, it may be appropriate to emphasise both teacher training and student induction in the use of ICTs. Computer laboratories and sessions during which time learners acquire ICTs and information skills may suggest centralisation of ICT facilities. However, since this strategy is geared towards integration of ICTs in subject areas, availability of workstations in classrooms also becomes desirable. Moreover, it seems that as more students gain access to technology outside of the school context through telecentres, libraries or their homes, computer laboratories may not be needed to perform the function of promoting familiarity with the technology and their purpose may be adapted to provide time for project-based, collaborative work. Clearly, professional development, which is dealt with below, is crucial to overcome the steep learning curve necessary for teachers.

Beyond questions of the most appropriate deployment of computer resources, lies the crucial question of ensuring that schools are receptive to the promotion and use of ICTs. What is required is an institutional climate that is open to ICTs work.

There appears to be general consensus that teachers are key to optimising ICTs in schools. There is a growing concentration on the role of the teacher and the kind of training they need in order to use ICTs effectively. Technology investments made without teacher training are wasteful. In the USA, the government has been advised to increase the portion of ICTs budgets for teacher training from 15% to 30% *(1999)*. The USA Congress Office of Technology Assessment asserts that:

> *Helping teachers use technology effectively may be the most important step to assuring that current and future investments in technology are realised (1995:2).*

The area of teacher training must address both pre-service (PRESET) as well as in-service training (INSET). It seems that many teachers are still reaching the classroom from their formal training with little confidence in how to use ICTs effectively, although policies cited above aim to address not only the training of teachers in-service, but also preparatory training. Practice at present still appears to favour INSET training due to teacher demand for such 'skilling'. It may well be the case that before teachers enter the classrooms, they are unaware of the extent to which these competencies will be central to their practice.

Teacher training courses should prepare teachers for working with technology effectively and confidently, but cannot simply impart 'technical' competencies. Teachers require the abilities to integrate ICTs into curricula, to design courses that will convey both content and skills and to be able to devise monitoring mechanisms. Most importantly, teachers need to be able to work in teams, across job categories, and increasingly, across geographic borders. Training in the use of ICTs therefore has to be part of a much richer education for teachers, and must address issues of pedagogy in the context of global change.

Some authors like de Moura Castro *(1999)* argue strongly that developing countries will only reap the benefits of this kind of training many years from now. A shortage of good teachers is a prominent feature of developing countries and must be worked around. However, it seems that teachers themselves are using INSET to better equip themselves and prepare for change. The difficulty seems to be the translation of broad rhetorical visions to real-life practical projects that allow teachers to feel part of a changing environment. In developed countries it seems that through various grants and funds that encourage innovation, teacher development is prioritised *(cf. Section 5)*. While the developing world may not be able to imitate these efforts on a grand

scale, the need to include key components of professional INSET and PRESET into strategic policies is especially important.

Costs and sustainability

Implicit in costing the use of ICTs in schools are a range of issues such as the various components that have to be costed as well as the standards that are used for provision. In unpacking the costs of ICTs in schools, a long list begins to unfold: teacher training, additional advisory and technical staff, hardware, software, telecommunications infrastructure (e.g. phone lines) and content development costs are some of these. Initial expenditure has to be considered along with recurrent costs and issues of sustainability.

In the Organisation for Economic Cooperation and Development (OECD) countries, it is estimated that US$16 billion per annum is spent on hardware, software and communication links in education *(Alexander, 1999: 9)*. It is also estimated that in the commercial sector, a computer, including the cost of purchase and maintenance is close to five times its initial price (*Lynch, 1999*). Furthermore, technologies should be used as extensively as possible to improve return on investment which in itself often generates new needs and innovations which may encounter unforeseen additional expenses *(de Moura Castro, 1999: 40).*

For developing countries these challenges are difficult and vast. Benchmarks of developed countries with regard to computer:student ratios are inappropriate and unattainable. What confounds issues is the degree of diversity within developing countries so that in small pockets of the education sector, developed country standards are probably matched and in some cases improved. In these instances, local elitist standards are confused with the norm (e.g. a highly resourced private school is situated in a rural area of South Africa). The real difficulty is how best to invest in those areas which have very little if anything by way of ICTs in education, i.e. the areas in greatest need and at greatest risk of being excluded.

Most authors, basing their arguments on experiences in those countries that have been active in the field for a while, argue strongly that investment in people and especially in teacher training is the most important item of an ICTs budget *(Alexander, 1999; USA Congress Office of Technology Assessment, 1995; Froese-Germain: 1998)*.

In some countries, for example, schemes are being put in place to help teachers purchase their own computers in the belief that easier access to the technology will improve teacher competencies in innovative use.

Costing frameworks that help schools deal with purchasing decisions and procedures are also on the increase providing for district and provincial co-ordination. While these are helpful measures, they still do not address the issue of how developing countries can afford ICT education and at what cost.

The area of costing, as with all others, is directly linked to so many other considerations in adopting ICTs in schools. At a macro level, there are conceptual issues of whether schools in developing countries can support the kind of investments required to make their ICT strategies meaningful enough to work. There are also, as has been argued above, arguments about whether they can afford not to become involved in ICT education. What the costing considerations then raise are how developing countries, given other pressing educational needs and resource shortages, can become involved in ICT education to ensure that they do not run the risk of exclusion but are making sensible investments that will generate returns. It is suggested that if developing countries are innovative in the use of ICTs, they will avoid the temptation to copycat expensive experiences

in the developed world. De Moura Castro makes a strong argument against such replication:

> *…developing countries cannot afford to ignore the costs of education in its different modalities. They cannot afford the same technologies being used in the industrialised nations. In many cases, the alternatives are either to have expensive technologies for a privileged few, or to have more economical alternatives for a larger share of the school-aged population (1999:41).*

The more specific concerns about costing relate to the cost-effectiveness of using ICTs in schools and the design of realistic costing strategies that address issues of sustainability. The difficulty with determining cost-effectiveness has to do with the need to map the effectiveness of technology education as opposed to increased expenditure on other areas such as improved libraries and laboratories or more teachers. Such evidence does not yet exist.

However, de Moura Castro argues for investing wisely in appropriate forms of ICTs that do not rely on what is already lacking in the education system such as well-trained teachers. Instead he advocates using existing conditions to reach constituencies that conventional systems of instruction cannot reach *(1999: 42)*. In other words, he argues that instead of relying on extensive professional development to accompany the introduction of ICTs into schools, developing countries turn instead to television broadcasting as a means of improving access to education. High-quality broadcasts achieve economies of scale in using limited professional expertise to develop programmes that can reach a much greater audience. He refers to the Telecurso 2000 example of Brazil and the Telesecundaria model of Mexico as cost-effective uses of technology to bring high-quality education to learners who might never previously have accessed such teachers or programmes. This use of ICTs relies on pre-existing infrastructures and therefore does not require extensive expenditure in this area.

Although there is insufficient evidence to suggest that the levels of learning achieved in this way are on par with those achieved in conventional educational settings, there is no doubt that these programmes reach significant numbers of learners. The programmes are supported in classrooms by facilitators who are not expected to impart the subject matter contained in the programme, but to provide support to learners who attend these centres. An interesting point is that the best examples of educational television come from developing country contexts, not from the developed world, which has the resources to use ICTs to enhance already well-established education systems.

Realistic budgeting

When schools budget for ICT expenditure, they seem to commit a significant portion to hardware and software purchases (at the expense of teacher training) and appear to regard this as a once-off cost. Costs of installation, maintenance and expansion remain hidden unlike in the commercial sector where 'the capital cost of a PC represents only one fifth of the yearly cost of running that PC' *(Lynch, 1999)*.

It seems that in the US for example, school districts are spending only half of what they should be spending on teacher training and the bulk of IT budgets are being spent on hardware and software. It is estimated that the costs in the US of building a technology-rich education system with low computer to student ratios and wired schools will amount to five times the current per capita costs of hardware per annum *(Froese-Germain:1998)*. This excludes the additional human resource costs that are clearly a crucial component in maximising the gains of any ICT strategy.

In Africa it is estimated that less than 1% of people use or have access to the Internet *(ADF, 1999)* while the US tops the list of Internet using countries. It is also estimated that in the US between 1995 and 1998, the number of home computers rose from 13 to 31 million *(Heyneman, 1999)*. These figures provide a sense of the scale of discrepancies globally, hinting at the unaffordability of ICTs on a global scale in developing countries.

These observations point to the fact that developing ICTs in schools requires long-term planning which takes account not only of issues of sustainability, but also the new kinds of developments that ICT education may generate. For instance, if schools are going to invest in software or content development, these costs should be budgeted for. The significant financial requirements and the dependency on donors and external funding that this entails may well cause developing countries to consider less expensive strategies such as educational television in combination with community learning centres or telecentres. It seems that multi-pronged strategies, which allow developing countries to experiment with different kinds of ICT interventions in different settings, may well allow countries to develop their own models of best practice.

In other words, schools need to consider a resource strategy that maximises the impact of ICTs and that entails balancing investment in computers (hardware and software) with investment in other technologies that might be cheaper and equally effective (e.g. video recorders, television sets). Investment in ICTs should maximise the use of the full range of available technologies.

Access and social justice

There is little doubt that in many instances ICTs are bridging some divides and widening others. While extensive research is being done on how gender disparities and other forms of injustice are being reproduced or introduced, there is also common knowledge about the context of global impoverishment in which the use of ICTs is unfolding. The conditions of extreme wealth on the one hand and widespread poverty on the other will not be remedied by technology or any other development strategies overnight, but planners must nonetheless remain vigilant of them.

In terms of access to ICTs, there is a rather simplistic notion that equity simply has to do with planning for equal access to technology. Thus 'leveling the playing fields' is seen in terms of the equal distribution of resources in accordance with set standards and criteria applied across the board. However, such planning takes little account of the fact that like information, access to technology is not an end in itself, but merely a means to achieving educational, decision-making and other goals. As described by the *USA Congress Office of Technology Assessment*:

> *It is becoming clear that actual equity for technology today goes well beyond machine counts; in fact, machines are a necessary but not sufficient component of teaching and learning. Students in some classes may have access to machines, but nothing available from or through the hardware of any real value. Likewise, teachers need to be able to locate and retrieve information, collaborate with others electronically, and develop and share materials at their own pace for their own needs. In the information age, access to necessary information may be the true measure of equity (1995: 43).*

This argument underlines the need for ICT interventions to be part of holistic, comprehensive policies in order to truly add value to an educational experience. It raises the importance of the mediation of technology by educational planning that ensures effective use.

With regard to gender disparities, the context into which ICTs are being introduced globally is one of male domination of the sector

at virtually all levels. Men occupy most policy and decision-making positions as well as management, technical and supervisory roles in the sector *(Goddard et al. 1999)*. In Africa, there are fewer girls attending school than boys and even lower rates of women in science and technology than men *(Karelse, 1998)*. In terms of the literacy barrier, there are 1.35 billion illiterate people amounting to more than 30% of the global population and for every illiterate man, there are two illiterate women *(Mansell and Wehn, 1998:35)*.

While various initiatives are underway to address these and the many similar inequities prevalent in all societies, policy interventions have to explicitly contain strategies promote gender equity.

Two interesting initiatives towards building equity are both USA based, offering different approaches that could be used in developing contexts. The first is a project called Cyberspace Regionalisation that uses ICTs to combine two schools in close proximity to each other, which are divided along racial and income group lines. The project is described as a 'unique test of the ability of telecommunications to increase the social purposes served by schools' *(Becker, 1999)*. The major goals of the project are to:

1. create an infrastructure of tele-communications to connect two high schools separated by 70 miles.
2. familiarise and train teachers and students at both schools in the use of ICTs.
3. create programs or activities to bring the students and teachers together.
4. apply those programs to issues of racial understanding.
5. apply those programs to improvement and reform in the two schools.

These project goals are loosely based on the 'Contact Hypothesis' posited as early as 1954 by Gordon Allport. In its most basic form, this hypothesis holds that, under ideal conditions, contact with members of different cultural groups promotes positive, tolerant attitudes *(Becker, 1999)*.

A second programme which is exclusively concerned with the kinds of divides generated and fuelled by the information age is the US National Telecommunications and Information Administration Series: 'Falling through the Net' in which the digital divide in the USA is constantly monitored *(1999)*. While this may well be an expensive exercise to undertake on a national scale, it seems imperative that programmes are installed to measure the ways in which ICTs are affecting society or at least a sector of society.

The latest report signals a growing divide between low-income groups in relation to home Internet access. The research thus also provides indicators of the extent to which the society as a whole is participating in information age type activities, presuming that Internet access is one such measure. In the USA, community access centres are being used (and their use measured) as a viable means of access to groups with no other means of affordable access to the Internet.

Research and development

Research into ICTs in education and the evaluation of such programmes requires extensive consideration of a wide range of variables including socio-cultural setting, curriculum and teacher preparedness which might previously not have been considered to impact on performance. An argument for comprehensive investigations which do not attempt definitive, global statements but which give detailed insight into micro initiatives so as to assist with intelligent planning has already been made. Such insights may not have very broad appeal, but do allow administrators much greater confidence in using ICTs to

direct desired change. In addition, evaluation research and development is critical both to understand and direct the ICTs arena globally. A greater understanding of how ICTs can be used to promote equity, to bridge divides and to address social as well as economic demands, would greatly assist with informed decision-making. It has become clear though that these investigations are not simple and that they are usually time-consuming and costly.

The rate of change in ICTs means that the nature of investigations are changing, new questions are being asked requiring different methodologies. Honey et al. state that researchers are learning to ask questions from an educational perspective rather than to pose questions from the point of view of the technical capabilities. These investigations are yielding a greater understanding of educational aims and achievements *(1999).* However, Norris cautions:

> *there are real barriers for teachers and administrators in gaining access to the wisdom in … research. Currently, research is written with other researchers as an audience; currently, there are precious few tools for practitioners to use in accessing research; and there are significant gaps in the research since practice has not been a major driver of the research (1999).*

These reservations aside, research and evaluation in the field of ICTs in schools is expanding. Developed countries have a clear idea of the relevance of research to the development of this field. In response to the pressures to measure the success of ICT interventions in education, the USA Rand Corporation has published a sourcebook on evaluation of education technology programmes entitled: Evaluating Challenge Grants for Technology in Education *(1997).* The authors, Bodilly and Mitchell, site a range of influences that must be considered in any evaluation of ICTs in schools programmes. They believe that increase in school attendance, homework completion, changes in student performances, increased application of research and higher-order cognitive skills should all be measured as part of an assessment. Heinecke *et al.* argue that longitudinal studies which trace changes over time will be necessary to indicate improvement in school performance and that comparative studies may be necessary to assess the suitability of innovations to different settings *(1999).* They refer to The Integrated Technology Adoption Diffusion Model, developed by CMC Corporation to state that:

> *Evaluations should include the contexts within which technological innovations occur. This includes looking at technological factors, individual factors, organisational factors and teaching and learning issues (See Sherry, Lawyer-Brook, and Black, 1997). Evaluation designs must be flexible enough to attend to the varying degrees of adaptation occurring with different content areas. Evaluations must include implementation assessments, formative assessments as well as standard summative and outcomes assessments. Evaluations must include the quality of training programs offering teachers the opportunity to learn new technologies within relevant, subject-specific contexts (1999).*

This excerpt highlights the complexity of evaluations into ICTs in schools and their impact on learning. It also points out that evaluations in this area seem to be an enterprise on their own, often being extremely expensive operations requiring expertise beyond that usually held by well-trained teachers.

It is important for developing countries not to be constrained in their approach to this issue. It seems that the challenge remains for innovative teachers to find ways in which they can practice and teach their students self-reflection to build up records of experience of ICTs in ways that add value to investigations that seek to report on this. To help teachers

document a project's development (and student achievement in it), programmes such as Quality School Portfolio that allow for mapping of student progress and comparing experimental and control group scores are on the increase *(Heinecke, et al: 1999).* These are tools that can assist with evaluation, but do not answer the greater need for an evaluation framework that will help teachers have a sense of what their efforts are achieving.

A South African study into levels of information literacy among higher education learners generated some interesting issues for evaluation research. Sayed *(1998)* and Badat, Sayed & Watters *(1998)* note that part of the problem of understanding ICTs in education is the difficulty of measuring the extent to which the technology itself is the key variable in improving learning and achievement. The range of variables that influence learning are often multiple, interact in complex ways with the outcome not always apparent. It is therefore difficult to identify with precision the role of technology in learning.

Similar to the studies above, Sayed *(1998)* notes that it is important to adopt a comprehensive approach to ICTs in education which considers levels of student confidence and motivation, issues of access to technology, and the ability of learners to critically evaluate information obtained from, for example, the Internet. In other words, evaluations of ICTs in education need to understand learning in a multi-dimensional way.

Sayed's 1998 research highlights the extent to which prior learning experiences affect student learning, and strongly emphasises the extent to which the use of ICTs in education in South Africa reflects race, gender, and institutional inequities. This confirms the need for contextually specific investigations of ICTs in education in South Africa. The study also highlights the need for processes of evaluating ICTs that are participatory, interactive and involve policy-makers who are active in shaping ICTs policy. Such an approach creates a favourable climate for ICTs intervention and creates opportunities for changes in institutional cultures and priorities.

Conclusion

This chapter has attempted to show that the impact of ICTs in education raises complex questions about teaching, learning, assessment, research, human resource development, budgeting, school policies and equity. A crucial recommendation from the UNCSTD Working Group is that investments in ICTs for education should guard against massive initial resourcing without a proper long-term plan that will ensure sustainability. This is a particularly important lesson for developing countries such as South Africa.

5

The South African policy and schooling context

As with other basic services, the distribution of education and training provision in our country follows a pattern of contrasts and paradoxes' (Dept of Education, 1995:18).

These contrasts and paradoxes continue to dominate and define our education system and are especially evident when policies of change are put into practice.[1] Obviously they impact on the provision and use of ICTs in South African schools. They also provide insights into the opportunities for growth and development in this area.

To identify the critical issues that have shaped the present level of provision of ICTs in schools and the nature and extent of their use, two areas of concern are considered in this chapter. The first area concerns various policy initiatives that have been put in place since 1995 to influence the development of quality education through effective teaching and learning. Here, we look first at broad policies on schools development and at curriculum changes that impact on ICTs and then we discuss policies specifically about ICTs. The second area is the actual inequalities that continue to permeate the schools sector in South Africa at this time. We describe some of the trends in education on the ground. These two interrelated areas are particularly important in understanding present ICT use and for informing choices for the future.

General policy on transformation in schools

Policy in South Africa has moved a long way towards promoting and understanding the role of ICTs in society in general and in education in particular. There is a rich and productive discourse about ICTs that provides a useful starting point for promoting ICTs in education. The real challenge, however, lies in the ability of the policy framework to enable schools to overcome the inequalities of the past and provide quality education for all learners.

Since 1994 a number of new policies have been developed and implemented which have substantially altered the education system in South Africa. The most important of these has been the establishment of a single, education system to replace the separate, racially defined, education departments that previously existed. The general philosophy, principles and goals for education are expressed in the White Paper 1 on Education and Training *(1995)*. The way in which schools are organised, governed and funded is outlined in the South African Schools Act *(1996)*.

These two documents have been important in shaping the policy environment for the provision and use of ICTs in schools. It is important to recognise that any strategies developed around ICTs in schools have to be based on the principles outlined in the White Paper.

1. This chapter is based on a report prepared for the EPU by the South African Institute for Distance Education (SAIDE).

These principles can be summarised as follows:

- A commitment to providing access to quality education, and a right to basic education as enshrined in the Bill of Rights.
- A commitment to developing the full potential of South Africa's people for their active participation in all processes of a democratic society and their contribution to the economic growth and development of the country.
- Redressing imbalances of the past through the implementation of new teaching and learning strategies for the effective and flexible delivery of services within various learning contexts and through the equitable distribution of technological and other resources.
- Implementing learner-centred and outcomes-based approaches to education and training in order to achieve quality learning based on recognised national standards.
- Enabling all people to value, have access to, and succeed in life-long education and training.
- Developing a problem-solving and creative environment in which new technologies are harnessed to produce knowledge, products, and services.
- Integrating technology into the strategies intended to reach these goals so as to advance South Africa's ability to harness new technologies in its growth and development.

In line with the provisions of the Constitution, the practical implementation of these principles is the joint responsibility of the national and provincial departments of education. The National Department of Education is responsible for developing policy and setting national norms and standards and the Provincial Departments are responsible for the provision of education. Provincial responsibilities include: provincial legislation, finance, personnel, logistics, information and physical facilities, provision of books, examinations and computer services.

To undertake this responsibility, provinces have had to restructure, incorporating various departments into one coherent education department. In addition, they have had to develop and adopt strategic plans to operationalise their responsibilities. The degree to which provinces have moved towards assuming autonomy and authority for education is uneven and this has important implications for the management and support of ICT use in schools as will be seen later in the chapter.

In the schools themselves, ownership, governance, and funding are set out in the South African Schools Act (*1996*). The Act, besides repealing all apartheid legislation pertaining to schools and providing for a single schooling system, also abolished corporal punishment and introduced compulsory education for children between the ages of seven and fifteen. Despite the historical significance of the Act, the process towards its development was marked by severe contestation, over provisions such as school fees and the composition and powers of governing bodies. The Act provides for the setting up of governing bodies at all schools, which should be composed of parents (the majority group); educators; pupils (in secondary schools); non-educator staff and a co-opted non-parent member of the community. The Act also provides for a system of user fees (school fees) to supplement limited state funding to schools. [2]

While all these regulations are significant for the provision and use of ICTs in schools, it is the area of school fees that is of particular importance. The implications of this source of funding for ICTs in schools are addressed in Chapter 6 through the findings of the survey. However, it is important to note here that the

2. Based on a contribution by Salim Vally in 'Poverty and Inequality Hearings: Education Theme' by Vally, Chisholm & Motala, 1998. Also, 'Education Policy and Implementation' in Quarterly Review of Education and Training in South Africa, 5, 3. Vally & Spreen, 1998.

system of compulsory school fees, which supplements state allocations to schools, has perpetuated a number of the resource disparities in the education system.[3]

Linked to the above has been the government's setting of national norms and standards for school funding. As might be expected, a core focus of these national norms and standards is on redress of educational inequities within the system. The provisions of this policy provide for a framework of government spending on schools that directs greater state resources to the most disadvantaged schools. In addition, it focuses on pressing budgetary problems within the schooling system, possibly the most notable of which is the unusually large percentage of expenditure consumed by personnel items (i.e salaries). Both of these aspects are directly relevant to attempts to increase the use of ICTs at schools.

Curriculum changes

Changes implemented since 1994 have included the development of a new curriculum framework for learning and teaching. Outcomes-based education (OBE) is being implemented in schools through Curriculum 2005. This new framework seeks to change some of the traditional approaches to teaching. The following are the general shifts envisaged through the new curriculum:

- from content-based to outcomes-based education.
- from passive to active learners.
- from examination-driven to ongoing assessment.
- from rote learning to critical thinking, reasoning, reflection, and action.
- from textbook/worksheet-bound, teacher-centred education to learner-centred education, where the teacher is a facilitator of the learning environment.

Because it challenges traditional ways of teaching, the implementation of Curriculum 2005 is complex and highly contested. It has important implications for defining the teaching and learning framework in which ICTs will be used.

Recent curriculum development is beginning to suggest important ways in which ICTs can be integrated into forms of teaching and assessment. For example, in the senior phase of schooling, provision is made for a language, literacy and communication programme. Similarly, at the foundation and intermediate phases, there are explicit signals about the need for learners to access information beyond books and texts. The key challenge is to translate these signals into action for promoting ICTs in education.

All the education policy documents project a universal consensus about the importance of technology education for learners. In this, technological literacy is argued to be as crucial and basic as reading and writing. Thus it is assumed that by the end of the foundation phase of schooling, learners should be technology/information literate. Similarly, all the documents agree that the mastery of technology enhances the potential of individuals and leads to economic productivity. In this, there is an incessant discursive urgency about ICTs in education.

Policies specific to the use of ICTs in schools

Of the many policy texts dealing with ICTs, the most comprehensive and thought provoking is the Technology Enhanced Learning Investigation (TELI) commissioned by the Department of Education in 1995. The report has many productive suggestions for promoting technology enhanced learning in schools including information literacy courses, an information clearing house, and a

3. While the act provides for a system of compulsory school fees it also provides for exemption where parents are unable to pay.

Table 5.1: Distribution of schools across the provinces[4]

Province	Total Schools	Combined	Primary	Secondary	Specialised
E/Cape	5 880	1 006	3 892	960	24
Free State	2 881	141	2 418	296	18
Gauteng	2 233	207	1 413	559	60
KZN	5 409	152	3 865	1 344	41
Mpumalanga	1 907	111	1424	377	12
N/Cape	526	49	392	80	1
N/Province	4 170	59	2 713	1 372	11
North West	2 412	121	1 624	630	39
W/Cape	1 770	119	1 271	314	68
National total	**27 188**	**1 965**	**19 012**	**5 932**	**274**
% of national total	(100%)	7%	69%	22%	1%

learning site on the World Wide Web. Perhaps the most significant aspect of the TELI investigation is the emphasis (captured in the title) that technology is a means for improving education and not an end in itself. In other words, technology is a tool for learning if carefully deployed and is an aid to improving teaching.

For the most part, national policy on ICTs has focused on three key issues. Firstly, there has been a conscious attempt to improve the coverage and delivery of the necessary infrastructure for ICTs (White & Green Paper and Tele-communications Act, as well as the Universal Service Agency Working Document). Secondly, policy has focused on establishing the regulatory framework and mechanism for the spread of ICTs in South Africa through the establishment of the South African Telecommunications Regulatory Authority. Thirdly, there is growing emphasis on the need for maths, science and technology as the key to growth and economic productivity in South Africa (Science and Technology White Paper).

Also at national level, the library sector has identified the importance of ICTs (National Policy on School Library Standards). The discussion document on School Library Policy marks a significant departure in government thinking in that it acknowledges that the spread of ICTs tends to blur the distinction between the work of librarians and educators. In other words, there is a growing acknowledgement that the spread of ICTs implies that library work in the field of information literacy is curriculum work.

At provincial level there are many policy documents on ICTs. As has been mentioned, the provision of schooling is a provincial competency and by implication, so is the promotion of ICTs in schools. There is thus tremendous diversity in ICTs between provinces. From a policy perspective, there is a need to consider how provincial ICT policy in education articulates with national policy.[5]

What really happens in schools

According to the School Register of Needs, there were 27 188 schools in South Africa in 1996, the majority of which are to be found in the Eastern Cape, KwaZulu-Natal, and the Northern Province. Approximately 70% of these are primary schools. According to the 1996 data, the distribution of schools per province by number and type is provided in Table 5.1 above.

In 1994, the total number of learners enrolled at the primary level (Grades 1–7) was 7 890 519, and the enrolment figures for secondary learners (Grades 8–12) was 3 517 079. The total number of learners for 1994 was close to 11.5 million (*RIEP, 1995*). In 1995,

4. Source: Data from the 1996 School Register of Needs. Not included in table are technical colleges and schools where the type is unknown.

5. For government documents, including legislation, see http://www.polity.org.za

Table 5.2: Total learner enrolment per province[6]

Province	Total number schools in 1997	Total number learners in 1997	Total number learners in 1998	Percentage of increase in learners
E/Cape	5 880	2 110 015	2 403 127	13.9%
Free State	2 881	794 555	810 986	0.2%
Gauteng	2 233	1 474 152	1 566 538	6.3%
KZN	5 409	2 864 501	3 152 236	10.0%
Mpumalanga	1 907	872 513	1 010 221	15.8%
N/Cape	526	189 629	202 846	7.0%
N/Province	4 170	1 856 481	1 990 069	7.2%
North West	2 412	968 398	1 016 189	4.9%
W/Cape	1 770	871 569	891 699	2.3%
National total	**27 188**	**12 001 813**	**13 043 911**	**8.7%**

however, enrolment figures for the primary level were 8 159 435 and 3 749 448 at the secondary level, increasing the total to approximately 11.9 million learners *(Edusource, 1997)*.

This suggests that about 400 000 new learners enter the education system every year, with the greatest intake being between Grades 1–7. By 1998, South Africa's school population was about 13 million, of which 25% was in KwaZulu-Natal.

Much of the demand for schools in South Africa is at the primary level and most pupils are enrolled in Grades 1–7. In Tables 5.3 and 5.4 on page 57 show a breakdown of learner enrolment at primary and secondary level by province for 1997 and 1998.

A comparison of these figures gives a clear indication of the rate of increase in learner enrolments at primary and secondary levels. For example, in the Eastern Cape, the number of learners at the secondary level increased by about 54 000 from 1997 to 1998, while primary level enrolment figures increased by approximately 240 000. Nationally, enrolment at primary level increased by 605 000, and by 320 000 at secondary level. Whilst the majority of learners are enrolled at the primary level, enrolment trends suggest that there is also a significant increase in flow to secondary education. In addition, while it appears that more learners are passing through the schooling system, there is an overall decline in intake in Grade 1. The Grade 1 intake for 1995 was approximately 1 666 980 and in 1997 it had dropped to 1 558 019. [7]

Gender profiles

More boys than girls are entering the school system at the primary level, with an average ratio of boys to girls in the region of 1,05:1. Interestingly, this trend is reversed at the secondary level. In Grade 1, more boys enroll in schools than girls, but there are significantly more girls than boys in Grade 12. According to Monica Bot *(1998)*, this suggests that there is a higher dropout rate among boys in the higher levels *(Bot, 1998:128)*. Similarly, in line with the general trend towards the decreased enrolment in Grade 1, the intake of boys at Grade 1 in 1997 dropped by 8 000 from the previous year, while the intake for girls declined by over 34 000 pupils.

The picture presented above suggests that there have been significant shifts in enrolment patterns in South Africa since 1994. Most of the country's children are now attending school, and more learners are moving through the schooling system at the secondary level now than in previous years.

A comparison of the number of schools with enrolment patterns for each province (Table 5.2) provides some sense of the extent of school shortages. Out of South Africa's total enrolment figure of close to 13 million, almost seven million students attend schools in KwaZulu-Natal, the Eastern Cape, and the Northern Province. In the case of KwaZulu-Natal there are 5 409 schools in which to accommodate 2 864 501 learners. The Eastern Cape has 5 880 schools in which to accommodate 2 110 015 learners. So KwaZulu-Natal has more learners than the Eastern Cape, but fewer schools in which to accommodate them. Thus the demand for schools in KwaZulu-Natal is inevitably higher.

6. Source: Data from the 1996 School Register of Needs.

7. Note this information is based on data sets obtained from RIEP.

Access to resources

Many schools are still plagued by inadequate provision of material and physical resources. These range from a lack of textbooks and other teaching materials, to classroom shortages and lack of facilities such as libraries and laboratories. According to the School Register of Needs Survey *(1996)*, only 17% of schools have libraries and about 50% of schools have an adequate supply of textbooks (*from Edusource, 1998*). Overall, schools in the Northern Province, and Eastern Cape are the worst off in terms of infrastructure such as condition of buildings, libraries, laboratories, water supply, electricity supply, ablution facilities, and telephones. Schools in the Western Cape, Gauteng, and the Northern Cape are generally in a better position, although there are also major discrepancies within provinces.

The extent to which learners' needs regarding provision and upgrading of classroom facilities are being met varies from province to province. In the North West province, which has a backlog of 4 000 classrooms, 511 classrooms were constructed during the 1995/6 financial year *(SAIRR, 96/97:7)*. Similarly, in Mpumalanga, 48 new schools were built and 226 damaged schools were renovated during 1997. The province estimates that an additional 4 325 classrooms are needed to overcome backlogs *(SAIRR, 96/97:7)*. In the Northern Province, during the 1995/6 financial year, 1 000 new classrooms were built, and an additional R200 million was set-aside in 1996/7 for new schools *(SAIRR, 96/97:7)*. In Gauteng, 2 219 classrooms have been built over the past four years. The Eastern Cape department of education reports that its 1998/99 budget did not allow it to make provision for the building of classrooms, thus leaving the department with a shortage of about 20 000 classrooms *(Edusource, 1998:6)*.

Table 5.3: Enrolment in primary schools per province[8]

Province	1997	1998
E/Cape	1 534 462	1 773 911
Free State	511 276	519 661
Gauteng	946 448	990 618
KZN	1 972 386	2 128 098
Mpumalanga	578 599	666 743
N/Cape	130 860	141 273
N/ Province	1 167 160	1 252 757
North West	632 535	660 516
W/Cape	587 422	596 754
Total	**8 061 148**	**8 730 331**

Table 5.4: Enrolment in secondary schools per province[9]

Province	1997	1998
E/Cape	575 553	629 216
Free State	283 279	291 325
Gauteng	527 704	575 920
KZN	892 115	1 022 010
Mpumalanga	293 914	343 478
N/Cape	58 769	61 573
N/Province	689 321	737 312
North West	335 863	355 673
W/Cape	284 147	294 945
Total	**3 940 665**	**4 311 452**

It is important to recognise that although some provinces may have an average teacher/pupil ratio within the national norm,[10] significant classroom shortages mean that, in reality, teachers have much larger classes. In the Northern Province, for example, the average provincial teacher-pupil ratio is within the national norm. The shortage of classrooms in the province (as indicated by a teacher-classroom ratio of 1,4:1) implies that about half of the primary school teachers are likely to have classes larger than 40 learners, and as many as 519 000 primary and secondary learners (37%) are in classes of about 70 learners (*JET, 1997:4*). A similar situation exists in the Eastern Cape, which has a teacher-classroom ratio of 1:51, requiring teachers to teach up to 51 learners. These two provinces have the

8. Education and Manpower Development 1997, No 18 RIEP, Faculty of Education, University of the Orange Free State.

9. ibid.

10. The national norm for teacher-pupil ratios, proposed by the national Department of Education, is 40:1 in primary schools and 35:1 in secondary schools. The national Department of Education recently proposed a 'national ceiling for teacher/pupil ratios of 39:1 for the 1999 school year.

Table 5.5: Provincial distribution of schools with one or more computers in 1996

Province	Number of schools with computers	Percentage per province
Eastern Cape	212	9.2%
Free State	155	6.7%
Gauteng	606	26.2%
KwaZulu-Natal	355	15.4%
Mpumalanga	146	6.3%
North West	130	5.6%
Northern Cape	105	4.5%
Northern Province	57	2.5%
Western Cape	545	23.6%
Total	**2 311**	**100%**

greatest classroom shortages *(JET, 1997:129)*. As a general trend, teachers in the Northern Province, Eastern Cape, and North West share classrooms, teach outside, or use non-teaching areas.

With the responsibility for educational provision having been devolved to the provinces, the related issues of classroom shortages and teacher-pupil ratios have become the responsibility of each provincial department. This means that provinces now have the power to determine their own ratios based on their budgets. Thus, those schools that are in a position to raise extra funds to employ extra staff and build more classrooms are able to maintain lower teacher-pupil ratios.

Inadequate provision of resources is not confined to classrooms or library facilities. As mentioned above, there is a severe shortage of textbooks for South Africa's 13 million learners. The School Register of Needs Survey *(1996)* has shown that approximately 49% of schools have an inadequate supply of textbooks. By mid-1998, Grade 1 classes in six provinces were without textbooks, largely due to a lack of funds. Despite these backlogs, government spending on textbooks decreased from R851m in 1995/6 to R381m in 1996/7 and R226m in 1997/8 *(Edusource, 1998:10)*.

Access to computers

Within context outlined above it is not surprising that in 1996, according to the School Register of Needs Survey, only 2 311 schools were in possession of one or more computers. This amounts to approximately 8.8% of the total school population, i.e. in 1996 less than 10% of schools had access to computers. Similarly, as with other resources, the pattern of computer resource distribution mirrors inequalities between and within provinces. Stark inequalities are also evident when the distribution of computer resources are looked at comparatively between schools in rural areas, schools in urban areas and those in peri-urban areas.

Table 5.5 above shows the distribution of schools with one or more computers in 1996, according to the School Register of Needs database. Figure 5.1 shows the distribution of these schools according to their location. The distribution of schools with computers compared to those without (Figure 5.2) shows clearly that ICT resources are primarily an urban phenomenon. It also shows the stark inequity that exists between urban and rural schools.

The broad picture presented above shows that over 90% of schools still have insufficient and/or inadequate resources. The historical legacy of schooling in South Africa means that there exists a substantial backlog in terms of minimum educational requirements, with limited government funds to meet the needs of learners. As Vally & Spreen have noted:

> *a differential education system continues to exit where differently endowed communities enjoy widely varying levels of provision and only some are able to meaningfully supplement state resources (Vally & Spreen,1998:7).*

Funding for computers

It was noted that the *National Norms and Standards for School Funding (1998)* provide a

framework for state expenditure, which is aimed at redressing the inequities in schooling. Recurrent cost allocations to schools from provinces are now based on a formula where the most needy schools will get priority in funding. In principle the norms and standards provide a funding mechanism for achieving redress, and could potentially increase the use of ICTs in schools in disadvantaged communities. However, if recurrent cost allocations are swallowed up by other needs or priorities and cannot be used for the funding of ICTs, it is likely that the costs of ICT provision and maintenance will come from additional funding generated by school governing bodies.

In this context, the roles and responsibilities of governing bodies and the contribution of parents to school funding become especially significant. The South African Schools Act *(1996)* makes provision for a governing body to 'take all reasonable measures within its means to supplement the resources supplied by the state in order to improve the condition and quality of schooling' *(1996:4(36))*. Similarly, as noted above, the Act provides for the compulsory payment of schools fees by parents.[11] Whilst on the one hand this may signal a positive move in the light of existing disparities, it may also mean that the gaps in schooling provision, will not only remain but may even widen.

The role of parents in school funding becomes even more significant, particularly for ICT provision, when the trends in spending on non-personnel items are considered. According to Chisholm and Petersen, non-personnel expenditure has been cut in real terms by 16% over the past three years (Chisholm and Peterson, *1999:2*). This means that despite the commitment on the part of the govern-ment to reduce the ratio between personnel and non-personnel expenditure, wage increases continue to push up the costs of educator personnel. What is most important, however, in considering the impact of this scenario on parent funding to schools, is that:

> *As non-personnel expenditure at school-level is decreased, parents are made to share a bigger burden of the education expenditure. In certain instances, this will result in improved service delivery at a lower cost but in many instances, the ability to pay will influence the quality of service received. This places poorer households at a disadvantage' (Department of Finance, Medium Term Expenditure Report, 1998, 22).*[12]

In a country in which there are large disparities in earnings among parents as well as high unemployment, the above scenario suggests that inequities between schools may actually increase. It is also likely that such disparities will be particularly evident for items that may be regarded by some as 'non-essential', including computers and other technology hardware. Moreover, it may not

Figure 5.1: Schools with one or more computers

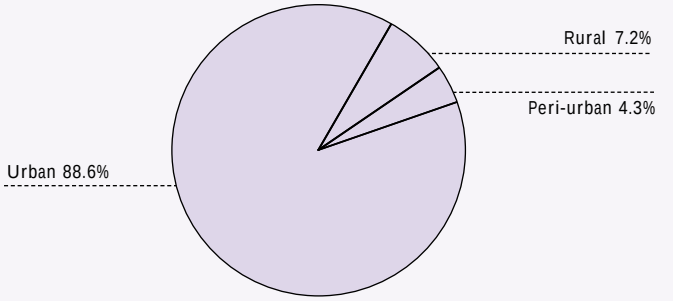
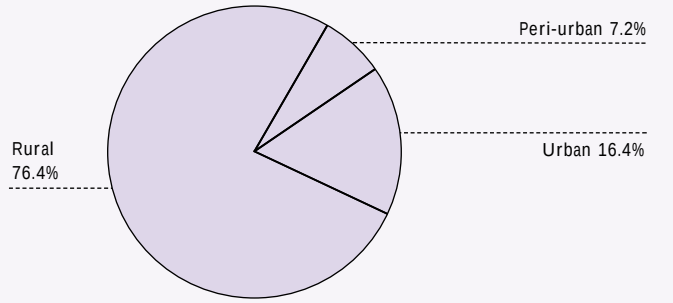


Figure 5.2: Schools with no computers



11. See note 3.

12. Quoted by Chisholm & Petersen, Quarterly Review of Education and Training, 6 (1).

only be the purchase of such resources that is of concern but also the costs associated with their maintenance. Thus, in an environment where state expenditure is heavily skewed in favour of personnel costs, and parents take more responsibility for funding, opportunities and possibilities for achieving equity in ICT provision will be severely undermined unless these patterns of expenditure are shifted. These trends in school funding create a greater imperative for ICTs to be seen as essential for building quality education among all schools, especially those previously disadvantaged.

Provincial and local disparities

As part of the process of provinces taking responsibility for the provision of education, strategic plans have been adopted in each province, thus beginning a process of departmental restructuring and the development of effective organisational and governing structures. The extent to which provincial education departments have made progress in effectively taking over areas such as finance, management, and the provision of facilities and textbooks differs from province to province.

It is reported that the Western Cape has made the most progress in taking over the various functions:

> *The most advanced province…is the Western Cape which by the end of July [1995] had taken control of more than 90% of the functions in areas of legislation, organisation, provision of books and physical facilities…KwaZulu-Natal and the Free State have also reported substantial progress, with the Northern Province and the Northern Cape lagging far behind in almost all areas (Edusource,1997:5).*

However, whilst the Western Cape has made considerable progress in comparison to other provincial departments, the impact of this across schools within the province has been uneven. As Garson notes:

> *Although the Western Cape's 2 000 schools fall under one administrative structure, the differences between them are so vast they may as well be hemispheres apart. One school has abundant resources, good access to the provincial department of Education, and sophisticated management and teaching skills that allow it to forge ahead with fund-raising and implementing the new curriculum. A few kilometres away, another school has none of these. Instead, it has violence, gangsterism overcrowded classrooms and ill-trained teachers in short supply' (Garson,1999:14).*

The Western Cape is obviously not unique with respect to differences between schools within a province. Indeed, a key feature of the education sector is that of disparity between schools under one provincial department. For example, in the Northern Province, schools in and around Pietersburg are in a much better position relative to schools in the former homeland areas of Gazankulu, Lebowa, and Venda. These former homeland areas were only amalgamated into the Northern Province education department late in 1996. Thus even within provinces the development of specific regions has been shaped by different historical, political and economic forces.

The disparities between schools under provincial education departments point to the problem of ensuring coherence and uniformity in terms of policy implementation from national to provincial, district, and school levels. It also underscores that the process of devolution and decentralisation of education is difficult, requiring effective planning and management, open and reliable channels of communication, and an immense amount of capacity-building. Different provincial departments are faced with different sorts of challenges as they grapple with the development and implementation of strategies

towards ICT provision and effective usage in schools.

Provincial departments have experienced considerable difficulties in the areas of finance and management. It is estimated that by the end of 1997, over-expenditure by provinces amounted to approximately R5.5 billion (*Dept. of Finance, 1998*). There are, however, indications that this pattern of overspending was significantly better controlled in the 1998/1999 financial year, a trend that was confirmed by the Minister of Finance's 1999 budget speech *(Business Day, Feb 1999)*.

As a means of dealing with the issue of over-expenditure, the national department of education announced that a new approach to spending would be introduced in 1999, with mechanisms to ensure that:

> *Schools and district offices would in future shoulder responsibility for their own finances. Each school would have a separate budget allocation…. Schools would have to develop their own budgets for maintenance, teacher costs, non-teacher personnel costs, textbooks and equipment (Edusource, 1998:1).*

However, an underlying assumption of this approach is that school staff and governing bodies have the necessary financial expertise to take on the responsibility of budgeting. As Vally & Spreen emphasise,

> *As schools are to become their own budget and cost centres, the burden of establishing, exempting and retrieving fees will be severe. Budget formulation and financial arrangements with district and provincial levels will require considerable expertise and…the need to afford governing bodies extensive training in financial management is therefore crucial' (Vally & Spreen,1998:8).*

Once again, it is likely that schools where parents and teachers have more experience and greater knowledge of ICTs will be more able to manage and sustain effective ICT development in their school. Clearly, these trends cannot be ignored in an environment where ICT skills are becoming a key differentiator in employment opportunities.

Profile of educators

Although the numbers of teachers presently employed in the formal schooling system can be fairly accurately calculated, opinions differ as to whether there is an oversupply or under-supply of teachers in the system. Different estimates of teacher vacancies make it extremely difficult to develop an accurate picture of personnel levels within the system.

Despite the uncertainties in determining educator levels, there is more consensus and certainty about the fact that the majority of teachers in both primary and secondary schools are women. In 1997 the Gender Equity Task Team (GETT) noted a female:male ratio among primary school teachers of 73.5:26.5 and a ratio of 63.8:36.2 at the secondary school level. Chisholm and Petersen, in commenting on a report by the Gauteng Department of Education, note that, according to the report, while women make up approximately 75% of the teaching force in the province, only 33% of them are principals *(Chisholm & Petersen,1999:3)*. This scenario is not limited to Gauteng. GETT provide combined figures for schools and technical colleges in 1997 which show that of the 36% of teachers who are males, 58% of them hold principal posts, 69% deputy principal posts and 50% hold head of department posts *(GETT, 1997:82)*. These figures therefore point to significant gender inequalities among the South African teaching force.

A profile of the teacher population in South Africa also shows that although a matriculation certificate plus three years higher education training is regarded as the minimum requirement for teachers, a

substantial number of CS educators have qualifications lower than this. Even though it would appear that skills levels are improving, a high percentage of teachers with low levels of skills obviously impacts on the quality of teaching and learning. Similarly, low levels of skill in general probably mean an even lower level of skill in the area of ICTs.

Over and above these problems is the low level of teacher morale. The Minister of Education, in outlining his plan of action for the next five years, commented in July 1999 that 'many teachers have been demoralised by the uncertainty and distress of rationalisation and redeployment' and that the expectation of job security and stability in schools 'has been long in coming' *(Asmal, 1999:3)*. In explaining this further he argues that the high levels of violence including drug-dealing, sexual abuse also substantially affect morale and other forms of physical assault, which permeate many of the schools in South Africa. Those teachers who manage to overcome these obstacles and are committed to their work are further demoralised by high levels of absenteeism and lack of discipline on the part of their colleagues and learners *(Asmal, 1999:3)*.

While these factors obviously impact on the context in which ICT development will take place, there are the more 'subtle and insidious' forms of demoralisation which arise when teachers are unclear or unconfident about the demands placed on them, particularly in regard to curricula and new forms of pedagogy. If it is recognised, as highlighted in international experience, that innovation and a commitment to new forms of learning and practice are key to the effective use of ICTs by educators, then the issues described above have the potential to create significant barriers to ICT development in our schools.

The nature of teaching and learning

As part of the government's commitment to the improvement of the quality of teaching and learning in schools, it launched the COLTS (Culture of Learning, Teaching, and Service) campaign in 1997. This campaign was launched in direct response to a breakdown in learning and teaching in a large number of schools across the country.

Despite these trends, effective teaching and learning (as evidenced by matriculation results) continues to take place despite adverse conditions in some of the poorest and most under-resourced schools in South Africa.

In the North West province, for example, a combined school of about 600 pupils from Grades 1–12 with 17 teachers, no laboratories, media centres, library or fence, achieved a 67% matriculation pass rate in 1997, placing it amongst the top 100 schools of South Africa (*Sowetan, 1998)*. Similarly, it has been reported that a secondary school near Thohoyandou achieved a 100% matric pass rate in 1996 'despite extremely deprived physical circumstances *(Cape Times, October 1998)*.

These exceptional cases highlight that, while it is essential for the state to tackle the serious issues of provision of resources and physical infrastructure, these factors do not, in themselves, provide any guarantee that effective teaching and learning will take place, nor is their absence sufficient explanation for under-achieving schools.

One of the most significant factors impacting on teaching and learning in the classroom is the high levels of violence to which many students and teachers are subjected. The violence in schools and/or adjacent communities impacts enormously on students. Violence in schools is not only limited to overt criminal or political violence

but is also experienced through high levels of racism in the schools.

Teaching and learning in schools has also been substantially affected by the implementation of the new curriculum framework. Since the introduction of the new curriculum, its impact across the provinces has been uneven. Vally & Spreen report that:

> *In rural or under-served areas it is estimated that at least 20 000 primary schools (one in five of the schools targeted) have failed to implement the new curriculum for reasons such as lack of teacher preparation or resource materials. Not surprisingly, the provinces that have fallen furthest behind are the Northern Province, KwaZulu-Natal, the North West and the Free State (Vally & Spreen, 1999:14).*

All provinces have experienced, to lesser or greater degrees, difficulties with the new curriculum. A study commissioned by the Gauteng Institute for Curriculum Development (GICD) ascribed the difficulties surrounding implementation of the new curriculum to 'inadequate training of teachers, a lack of materials and poor communication between department officials and teachers' *(Garson, 1999:6)*. The difficulties encountered with the implementation of the new curriculum looks set to continue well into the new millennium, with the Eastern Cape provincial department, for example, reporting that:

> *Curriculum 2005 was threatened with no finance available for materials and educator training, and the department did not foresee being able to extend the programme to grade two in 1999 (Edusource, 1998:3).*

An important component of Curriculum 2005 is the Technology 2005 project, jointly initiated in October 1994 by the Department of Arts, Culture, Science and Technology and the National Department of Education. Technology 2005 is a three-year curriculum development project, which aims to work with provincial departments in the development of:

- a national curriculum framework for technology education in the compulsory school phases.
- appropriate pre- and in-service teacher education programmes in technology education.
- systems for the implementation and evaluation of the Technology 2005 project in participating provinces *(JET, 1997:6).*

Attempts have been made to include ICTs in teacher training. For example, the Committee of Teacher Education Principals (COTEP) schemes suggest that all teacher trainees should cover mathematics and/or science and/or computers in their training. It is crucial that this happens as it provides new teachers with the skills they will require for ICT education.

In addition, some education departments have already begun instituting technology projects in schools. In the Northern Province, for example, 24 schools have been chosen to implement Technology 2005 *(Edusource, 1998:11)*. Initiatives such as these are rare and are primarily dependent on donor funding. As Shindler writes in Edusource, 'although technology education is to be part of Curriculum 2005, some provinces have no resources for schools, no training programmes for teachers and no strategies in place for implementation' *(Edusource, 1998:5)*. Thus while Curriculum 2005, and its associated Technology 2005 project, provides important frameworks for ICT development in schools, the reality of limited funding and capacity hinder the progress of their implementation *(Edusource, 1998:5)*.

Conclusion

Although discrepancies haunt the statistical information underpinning the trends described above, correction of these discrepancies is, however, unlikely to change the general patterns significantly. Hence, even based on existing data, these patterns present important strategic challenges to people contributing to the growing use of ICTs at South African schools. While we have a rich and thorough policy base from which to draw, the realities of conditions on the ground have the capacity to substantially shift policy intentions. In the area of ICTs, while the policy slate is not empty or barren, the real challenge lies in developing strategies that are effectively co-ordinated and implemented at all levels of the system.

6
Schools with computers

This chapter is divided into seven sections and provides a detailed overview of the findings from the questionnaires received from schools that have one or more computers. Each section deals with a specific aspect of ICT provision in schools by providing an overview of general trends that can be gauged through basic cross-tabulations of the data. The sections are:

- An audit of resources
- Teaching computer literacy
- Computers in teaching and learning
- Computer studies
- Funding and maintenance
- General school-computer context
- After hours use

The present chapter provides an overview of all the questions contained in the questionnaire, including a discussion of the most pertinent findings. Each section ends with a short summary of the main findings in each case. (For a further synthesis of all the findings of the study and a discussion of the policy implications, see Section C.)

As was mentioned in Chapter 2, specific grouping variables were selected to compare the findings and establish relationships between variables. The data was then analysed according to these variables, namely:

- type of school (primary, secondary and combined school).
- province (data for all nine provinces were analysed).
- year in which the school started to use computers (three broad periods were used).
- geographical location, i.e. whether schools were located in an urban, peri-urban or rural environment.
- Computer Studies offered as a school subject.
- total number of computers in use according to three categories, i.e. 10 or less, 11 to 29 and over 30.

The findings of the survey in this first level of analysis are presented in tables that show the responses of schools according to the six grouping variables listed above.

Audit of resources

This section is devoted to a discussion of results pertaining to:

- hardware: types and numbers of computers and printers per school.
- Internet access and connectivity: access to the Internet and e-mail and associated costs.
- software: types of software available and how much they are used in schools.
- home computers: access to home computers.

Table 6.1.1: Total number of computers (categories) per school

	Total number of computers (categories)			Total
	10 and less	Between 11 and 29	30 and more	
	Row %	Row %	Row %	Count
Type of school				
Primary	36	41	23	427
Secondary	22	36	42	338
Combined	29	40	31	121
Province				
Eastern Cape	34	43	24	80
Free State	34	41	25	71
Gauteng	21	29	50	226
KZN	27	50	24	161
Mpumalanga	40	27	33	48
Northern Province	53	13	33	15
Northern Cape	38	53	9	34
North West	37	35	28	43
Western Cape	34	40	27	243
Geographical location				
Urban/towns	27	40	33	787
Peri-urban/semi-towns	50	29	21	28
Rural	53	27	19	73
School started to use computers actively				
Before 1990	21	38	41	262
1990 – 1994	29	38	33	348
1995 and after	37	43	20	268
Computer studies as a school subject				
Yes	11	41	47	384
No	43	37	20	497
Computer skills teacher (recoded)				
Department/govt	20	43	37	578
Private/contract	14	45	40	139
Total	**19**	**44**	**38**	**717**

Hardware: computers and printers

Most schools in the sample (44%) have between 11 and 29 computers, and a substantial proportion (38%) have 30 or more computers. A fifth of the schools have 10 or less computers. Not surprisingly, secondary and combined schools tend to have a higher number of computers than primary schools. There are provincial differences that reflect larger socio-economic inequalities. Provinces such as the Northern Province and Mpumalanga are not as well-equipped as the Western Cape, Gauteng and KwaZulu-Natal. As far as geographical location is concerned, the pattern is as expected with urban and peri-urban schools better resourced than rural schools.

Table 6.1.2 shows that secondary and combined schools have, on average, higher numbers of computers than primary schools. In fact, the average number of Pentiums in use in secondary schools (17.3) is significantly higher than the average for all schools and is nearly seventy percent higher than the average number of Pentiums in primary schools (10.4). However, any measure of the average number of computers across all schools (mean) needs to be read with caution as the survey data also shows large discrepancies between schools. For example, while the overall average number of Pentium computers may be 17.3 for secondary schools, some schools have 60 computers while others have only five.

Schools that offer Computer Studies have significantly higher proportions of both new and old computers compared to those who do not. In addition, there are nearly twice as many Pentiums (18.17 per school) at schools that offer Computer Studies as a subject compared to schools that do not (9.41 per school). (Analysis of variance shows that these differences can confidently be generalised for the entire population of schools that have computers).

Schools which offer Computer Studies as a subject also tend to have a higher number of more modern printers (laser printers and bubble-jets) than schools that do not offer Computer Studies as a school subject. Schools that do not offer Computer Studies tend to have a marginally higher average number of outdated matrix printers.

Internet access and connectivity

The Internet is beginning to be used as a resource and communication tool in classroom teaching and learning. Internet access and connectivity requires the availability of appropriate hardware and software at schools. A major constraint, that tends to limit Internet use, are the costs of connecting and of transmitting information, images and data.

More than 40% of all schools sampled have access to the Internet. This national profile, however, masks some rather large differences when some other factors are taken into consideration. 49% of secondary schools have access to the Internet while 35% of primary schools have access. Similarly, schools in urban areas are better connected than their counterparts in peri-urban and rural areas. There are also significant provincial differences. Schools in the Western Cape and Gauteng are better off than most with nearly half of schools (49%) having access to the Internet. A relatively small proportion of schools have computers in the Northern Province and Northern Cape, and schools in these provinces also show the lowest provincial Internet connectivity at 12% and 21% respectively. One reason for this may be the high telephone costs that are associated with accessing the Internet by using direct telephone lines.

When Internet access is correlated with start-up date, the teaching of Computer Studies as a school subject and overall number of computers, the results are generally as expected. More schools that started using computers before 1990 are connected to the Internet than the late starters. Schools that offer Computer Studies are much better connected (56% versus 30%) than those who do not and schools which are well-resourced and have more than 30 computers are also better connected than those which have less computers.

Most schools (85%) gain access to the Internet through modems. There are only slight variations in this figure across provinces, geographical location and other grouping variables. Less than one in ten schools gain access to the Internet by means of leased lines. This is slightly more common in the case of schools in the rural areas (15%). These schools tend to be located in the Eastern

Table 6.1.2: Distribution of types of computers in use by type of school

Type of school		Older than 486s in use	486s in use	Pentium's in use
Primary				
	Median	6.00	4.00	5.00
	Mean	9.63	9.28	10.39
	Std. deviation	10.08	10.92	12.07
	N	260	284	320
	Sum	2 504	2 636	3 326
Secondary				
	Median	8.00	5.00	10.00
	Mean	11.49	11.00	17.33
	Std. deviation	12.74	12.13	17.37
	N	233	239	284
	Sum	2 678	2 629	4 922
Combined				
	Median	9.00	5.00	8.00
	Mean	11.47	11.56	14.29
	Std. deviation	11.11	17.09	17.71
	N	73	80	96
	Sum	837	925	1 372
Total				
	Median	6.00	4.00	7.00
	Mean	10.63	10.27	13.74
	Std. Deviation	11.39	12.39	15.55
	N	566	603	700
	Sum	6 019	6 190	9 620

Median = the middle value: that value where half the cases fall below, and half are placed above it Mean = average N = number of schools Sum = number of computers

Table 6.1.3: Internet access

	Internet access				Total	
	YES		NO			
	Count	Row %	Count	Row %	Count	Col %
Type of school						
Primary	154	35	285	65	439	49
Secondary	169	49	173	51	342	38
Combined	48	39	75	61	123	14
Province						
Eastern Cape	31	38	51	62	82	9
Free State	22	30	51	70	73	8
Gauteng	114	49	121	51	235	25
KwaZulu Natal	62	38	103	62	165	18
Mpumalanga	15	30	35	70	50	5
N/Province	2	12	15	88	17	2
Northern Cape	7	21	26	79	33	4
Northwest	11	26	31	74	42	4
Western Cape	121	49	124	51	245	26
Geographical location						
Urban/towns	338	42	462	58	800	88
Peri-urban/semi-towns	9	35	17	65	26	3
Rural	24	30	57	70	81	9
School started to use computers actively?						
Before 1990	129	49	135	51	264	30
1990 - 1994	143	41	209	59	352	40
1995 and after	100	37	173	63	273	31
Computer studies as a school subject?						
Yes	217	56	168	44	385	43
No	155	30	360	70	515	57
Total number of computers (categories)						
10 and less	44	16	234	84	278	30
Between 11 and 29	138	39	213	61	351	38
30 and more	197	69	89	31	286	31
Total	**379**	**41**	**536**	**59**	**915**	**100**

Cape and KwaZulu-Natal provinces.

Tables 6.1.5 and 6.1.6 reveal quite large provincial differences both as far as Telkom and Internet Service Provider (ISP) costs are concerned. Provinces such as the North West (R759) and KwaZulu-Natal (R543) seem to pay much more than the national average (R399) for their Telkom costs and the reasons for this should be investigated. The large differences in average Telkom costs per province (ranging between a low of R88 and a high of R566 per school) also warrant further attention.

Table 6.1.7 shows that nearly six in 10 schools, which have computers, also have a computer network. A more detailed analysis highlights variations to this. Higher than average percentages were recorded in two provinces: Free State (68%) and Gauteng (70%). On the other hand, Northern Province, Northern Cape and Mpumalanga recorded large proportions of schools without computer networks. Furthermore, schools in urban and peri-urban areas tend to have a network (61% and 58% respectively). A high proportion of schools (68%) that have a computer network started using computers before 1990. Schools that started using computers later show significantly lower levels of network connections. Similar levels of networking of computers are shown at schools (69%) that offer Computer Studies as a school subject within the curriculum of the school. The evidence also suggests that the propensity towards the networking of computers increases as the number of computers at the school increases.

According to the results presented in Table 6.1.9 half of all schools, which have computers, also have a file server. This tends to be the case irrespective of the type of school or the province in which the school is located. Some deviations from the rule are: in the Northern Province 88% of schools in a relatively small sample do not have a file server, in the Northern Cape 68% of schools are without file servers, and in Mpumalanga, 61% have no file server. The same qualification applies to rural schools, where 65% indicated that they do not have a file server. On the other hand, 50% of urban schools have file servers. As one would expect, the total number of computers per school is an important factor in determining whether a school has a file server or not. Only 18% of schools which have 10 or less computers have file servers, compared to 49% of schools which have between 11 and 29 computers and 80% of schools which have more than 30 computers.

Table 6.1.8 shows that a comparatively higher proportion of learners have their own

personal e-mail addresses compared to either management, administration or teachers at schools. The proportions from each of these groups at schools nationally where some have personal e-mail addresses are 43% of management, 27% of administration, 53% of teachers and 56% of learners.

Just over half of the schools that participated in the survey have e-mail addresses for some of the teachers. In 11% of the schools, more than 50% of the teachers have their own e-mail addresses. However, a majority of schools in the Free State (57%), Northern Province (58%), Northern Cape (81%) and North West (62%) do not have personal e-mail addresses for teachers. In the remaining five provinces, majorities of the schools indicated that some teachers at the school have their own personal e-mail addresses. Schools that started using computers before 1990 (61%), as well as those that offer Computer Studies as a school subject (63%) and schools that have 30 or more computers (73%) recorded higher levels of personal e-mail access for teachers at the school. The highest concentration of personal e-mail access (50% or more) for teachers at schools are shown to exist at combined schools (17% or 17 out of 103) and schools in the Western Cape (24% or 51 out of 215). Thus only a very small number of schools reported having personal e-mail for over 50% of their teachers.

In absolute terms, 434 schools indicate that some learners have personal e-mail addresses, and 424 schools indicated that some teachers at the school have personal e-mail addresses. The distribution of schools where learners have e-mail is uneven across provinces. Generally, schools in the Northern Province and Northern Cape, as well as schools situated in peri-urban and rural areas have no e-mail access for learners. A similar situation applies to schools that do not offer Computer Studies as a subject and schools that have 10 or less computers. Slightly more than 10% of

Table 6.1.4: Means of gaining access to the Internet

	How does school gain Internet access?				Total
	Modem	ISDN	Leased Line	Other	
	Row %	Row %	Row %	Row %	Count
Type of school					
Primary	89	1	6	4	158
Secondary	84	4	9	3	167
Combined	79	4	13	4	47
Province					
Eastern Cape	78	3	13	6	32
Free State	86		5	9	22
Gauteng	88	5	5	2	112
KZN	80	2	13	6	64
Mpumalanga	88		6	6	16
Northern Province	50		50		2
Northern Cape	86	14			7
North West	92			8	12
Western Cape	86	2	8	4	121
Geographical location					
Urban/towns	86	3	7	4	340
Peri-urban/semi-towns	73		9	18	11
Rural	78		22		23
School started to use computers actively					
Before 1990	80	2	11	7	135
1990 – 1994	88	4	4	4	146
1995 and after	88	1	9	1	95
Computer studies as a school subject					
Yes	85	2	10	3	216
No	86	3	5	6	160
Computer skills teacher (recoded)					
Department/govt	86	3	8	3	259
Private/contract	86	1	7	6	84
Total	**86**	**3**	**8**	**4**	**343**

Table 6.1.5: Average Telkom costs per school, per month

Province	Mean	Minimum	Maximum	N
E/Cape	R354.61	R60.00	R3 000.00	18
Free State	R126.85	R75.00	R500.00	13
Gauteng	R565.54	R38.00	R9 000.00	66
KZN	R557.67	R45.00	R5 130.00	43
Mpumalanga	R190.83	R96.00	R600.00	6
N/Province	R145.00	R90.00	R200.00	2
N/Cape	R419.00	R40.00	R1 800.00	5
Northwest	R87.75	R75.00	R100.00	8
W/Cape	R350.31	R1.00	R2 500.00	74
Total	**R423.37**	**R1.00**	**R9 000.00**	**235**

Table 6.1.6: Average Internet Server Provider (ISP) costs per school by province

Province	Mean	Minimum	Maximum	N
E/Cape	R314.86	R45.00	R1 500.00	17
Free State	R207.69	R50.00	R500.00	15
Gauteng	R392.78	R15.00	R6 000.00	68
KZN	R542.738	R10.00	R5 500.00	42
Mpumalanga	R155.00	R50.00	R400.00	6
N/Province	R400.00	R400.00	R400.00	1
N/Cape	R388.71	R6.00	R1 800.00	7
North West	R758.75	R35.00	R5 085.00	8
W/Cape	R364.38	R20.00	R3 000.00	77
Total	**R398.96**	**R6.00**	**R6 000.00**	**241**

Table 6.1.8: Proportions of various groups who have their own e-mail address

	None	< 50%	> 50%	Total
Email – management				
Count	452	234	107	793
%	57.0%	29.5%	13.5%	100.0%
Email – administration				
Count	569	125	83	777
%	73.2%	16.1%	10.7%	100.0%
Email – teachers				
Count	387	334	90	811
%	47.7%	41.2%	11.1%	100.0%
Email – learners				
Count	347	357	82	786
%	44.1%	45.4%	10.4%	100.0%

Table 6.1.7: Does school have a computer network?

	Computer network				Total	
	Yes		No			
	Count	Row %	Count	Row %	Count	Col %
Type of school						
Primary	252	59	175	41	427	48
Secondary school	203	59	142	41	345	39
Combined school	67	55	54	45	121	14
Province						
Eastern Cape	47	57	35	43	82	9
Free State	51	68	24	32	75	8
Gauteng	162	70	69	30	231	25
KZN	86	54	73	46	159	17
Mpumalanga	25	50	25	50	50	5
Northern Province	3	16	16	84	19	2
Northern Cape	14	41	20	59	34	4
North West	22	52	20	48	42	5
Western Cape	132	56	105	44	237	26
Geographical location						
Urban/towns	483	61	305	39	788	88
Peri-urban/semi-towns	15	58	11	42	26	3
Rural	29	36	51	64	80	9
School started to use computers actively						
Before 1990	177	68	83	32	260	30
1990 – 1994	190	55	157	45	347	40
1995 and after	158	58	113	42	271	31
Computer studies as a school subject						
Yes	263	69	118	31	381	43
No	261	51	246	49	507	57
Total number of computers (categories)						
10 and less	74	27	196	73	270	30
Between 11 and 29	215	63	129	38	344	38
30 and more	246	85	42	15	288	32
Total	**535**	**59**	**367**	**41**	**902**	**100**

Table 6.1.9: Does school have a file server?

	File server				Total	
	Yes		No			
	Count	Row %	Count	Row %	Count	Col %
Type of school						
Primary	197	47	221	53	418	48
Secondary school	172	51	163	49	335	39
Combined school	56	48	61	52	117	13
Province						
Eastern Cape	40	53	36	47	76	8
Free State	41	59	29	41	70	8
Gauteng	140	61	88	39	228	25
KwaZulu Natal	68	43	91	57	159	18
Mpumalanga	19	39	30	61	49	5
Northern Province	2	13	14	88	16	2
Northern Cape	10	32	21	68	31	3
North West	17	44	22	56	39	4
Western Cape	104	44	132	56	236	26
Geographical location						
Urban/towns	385	50	383	50	768	88
Peri-urban/semi-towns	14	58	10	42	24	3
Rural	27	35	50	65	77	9
School started to use computers actively						
Before 1990	144	56	114	44	258	30
1990 – 1994	164	49	171	51	335	39
1995 and after	122	47	140	53	262	31
Computer studies as a school subject						
Yes	223	59	154	41	377	44
No	203	42	282	58	485	56
Total number of computers (categories)						
10 and less	46	18	208	82	254	29
Between 11 and 29	165	49	173	51	338	39
30 and more	225	80	57	20	282	32
Total	**436**	**50**	**438**	**50**	**874**	**100**

schools indicated that more than 50% of their learners have their own e-mail addresses. More than half of these schools are located in the Western Cape (55%). 76% of these schools started using computers before 1995, 70% offer Computer Studies as a school subject and about 65% have 30 or more computers.

Software packages and usage

Schools were asked to indicate which software programmes they use and whether they use such packages frequently or infrequently. In Figure 6.1.1, we summarise the usage (without distinguishing between frequency of use) in descending order. As is evident from the graph, word processing software, spreadsheets and software for administrative purposes are used by more than two thirds of all schools that have computers. It is worth pointing out that there may be some overlap between these three categories as administrative software probably includes both word processing and spreadsheets packages. More than half of the schools (481 out of 962) use electronic information resources such as encyclopedias on CD-Rom, while presentation and database software are also used by a significant number of schools.

The results showed that most schools do use the software they possess to greater or lesser extents. Word processing and Administration software programmes were used frequently by 88% and 94% of schools respectively. Other software programmes which schools use frequently are Spreadsheets (60%) and Programming languages (67%). Only a small proportion of software is not being used at all. Software that is technically easier to use shows only minor under-utilisation, whereas software that lends itself to more complex technical applications tends to be under-utilised at between 10–35% of schools. Examples of these include: Presentation software (48%), Drawing

Figure 6.1.1: Software programmes used by schools (frequency of use)

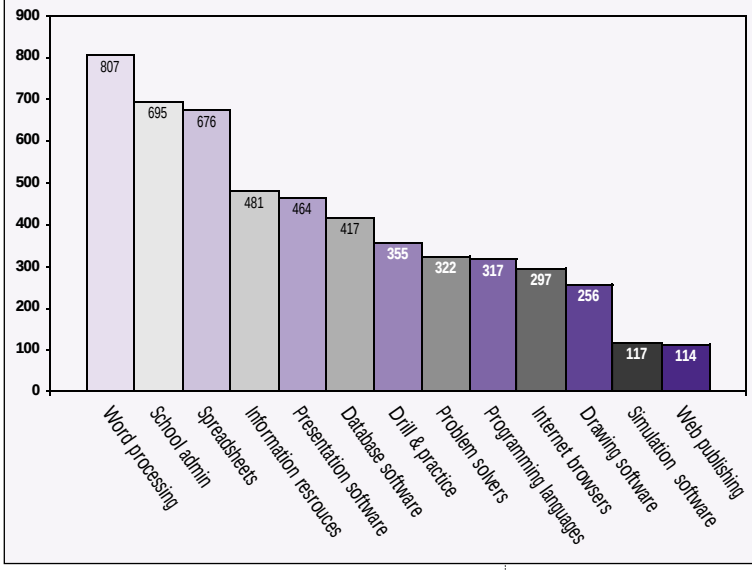


Table 6.1.10: Proportion of learners with e-mail addresses

	E-mail – learners						Total	
	None		Less than 50%		More than 50%			
	Count	Row %	Count	Row %	Count	Row %	Count	Col %
Type of school								
Primary	160	46	158	45	31	9	349	46
Secondary	124	40	150	49	34	11	308	41
Combined	48	48	38	38	15	15	101	13
Province								
E/Cape	26	41	33	52	4	6	63	8
Free State	28	47	31	52	1	2	60	8
Gauteng	78	39	106	53	17	8	201	26
KZN	66	46	65	45	14	10	145	18
Mpumalanga	19	45	21	50	2	5	42	5
N/Province	7	64	4	36			11	1
N/Cape	17	68	8	32			25	3
North West	15	48	16	52			31	4
W/Cape	91	44	73	35	44	21	208	26
Geographical location								
Urban/towns	281	42	316	47	71	11	668	88
Peri-urban	12	57	7	33	2	10	21	3
Rural	43	63	20	29	5	7	68	9
School started to use computers actively								
Before 1990	75	32	122	53	34	15	231	31
1990 – 1994	137	46	132	45	27	9	296	40
1995 and after	110	50	89	41	19	9	218	29
Computer studies as a school subject								
Yes	104	30	182	53	55	16	341	45
No	223	54	168	41	23	6	414	55
Total number of computers (categories)								
10 and less	144	67	65	30	5	2	214	28
Between 11 and 29	131	44	142	48	23	8	296	39
30 and more	56	22	147	58	52	20	255	33
Total	**331**	**43**	**354**	**46**	**80**	**10**	**765**	**100**

Table 6.1.11: Software programmes used by schools

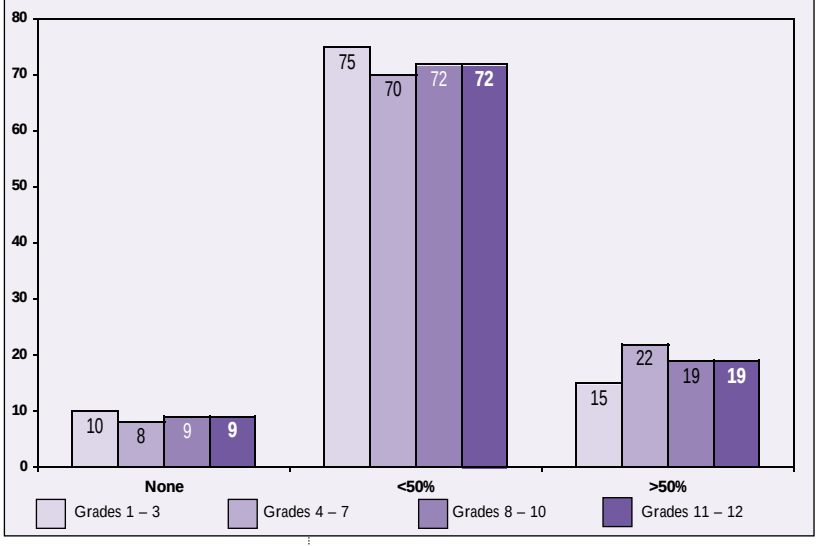
	Not	Infr.	Freq.	Total
Word processing				
Count	12	90	717	819
%	1	11	88	100
Spreadsheets				
Count	34	251	425	710
%	5	35	60	100
Presentation software				
Count	68	209	255	532
%	13	39	48	100
Drawing software				
Count	50	132	124	306
%	16	43	41	100
Internet browsers				
Count	53	119	178	350
%	15	34	51	100
Programmers				
Count	36	80	237	353
%	10	23	67	100
Administration				
Count	15	28	667	710
%	2	4	94	100
Simulation software				
Count	50	69	48	167
%	30	41	29	100
Database				
Count	71	189	228	488
%	15	39	47	100
Web publishing				
Count	61	69	45	175
%	35	39	26	100
Info resources				
Count	29	163	319	511
%	6	32	62	100

software (41%), Simulation software (29%), Database software (47%) and Web publishing software (26%).On the whole, between 4% and 43% of schools used the types of software listed in the table infrequently. On the other hand between 26% and 94% used these types of software frequently.

Home computers

In response to this question only 10% of schools indicated that none of their students have access to home computers. The majority of schools indicated that less than 50% of their learners have home computers while a smaller proportion indicated that more than half of their learners have computers at home. Figure 6.1.2 shows the breakdown of learners according to grades.

Figure 6.1.2: Access to home computers by different groups



Summary

- While the data contained in the survey must be used cautiously because national and provincial averages in the audit of resources mask regional variations, it still provides useful information. It can be observed that schools in provinces such as Gauteng and Western Cape appear to have better facilities and more up-to-date computers than schools in the Eastern Cape and Northern Cape. Schools in the Free State, KwaZulu-Natal, Mpumalanga and the North West provinces are walking a middle path between the two. There are however clusters of schools in each of the provinces whose resource endowments exceed the national average. It is likely that these schools were either previously classified as Model C schools, or are presently independent schools.
- Generally schools that offer Computer Studies as a school subject are better situated to develop a broad infrastructure of resources and make greater use of ICTs than schools that do not offer the subject. In addition to possessing a large number of computers, such schools also tend to be better connected to the Internet. Nearly 50% of schools in the Western Cape and Gauteng have access to the Internet.
- More effective managerial, administrative and teaching practices could be encouraged at schools if more teachers had personal e-mail addresses. At present, only 43% of management, 27% of administration and 53% of teachers at schools surveyed have personal e-mail addresses. This is especially true for teachers at schools in rural areas.
- Most of the software which schools possess is being used. However, there are some software programmes installed at schools that are not used at all. These tend to involve software that performs advanced and complex technical applications.
- Only 10% of schools indicated that none of their students have access to home computers. The majority of schools indicated that less than 50% of their learners have computers at home.

Computer literacy

This section addresses the issue of computer literacy and outlines the skills that are taught. We look at whether there are differences between male and female learners and the average number of hours spent on learning computer skills across grades. The question of who teaches computer skills is discussed and the issue of how the teaching of computer skills can be expanded is addressed.

An overview of computer skills taught in the different grades

The two figures below present overviews of the types of computer skills taught in primary and secondary schools respectively. In both cases, percentages are shown. Figure 6.2.1 summarises the results for Grades 1–3 and Grades 4–7. Figure 6.2.2 presents the results for Grades 8–10 and Grades 11–12.

The results illustrated in Figure 6.2.1 indicate clearly that up to Grade 7 the basic principles of computing and word processing skills are given the most attention. For Grades 1–3, 32% of the schools indicated that basic principles of computing are taught and for Grades 4–7, 38% of the schools recorded the teaching of these skills. Similarly, 17% and 35% of schools indicated that word processing skills are taught in Grades 1–3 and Grades 4–7 respectively.

The pattern towards a greater emphasis on the teaching of computer skills in general from Grades 4–7 is clear from Figure 6.2.1. Only 2% of schools indicated that web design skills were taught at either level. As expected, skills like these and other more complex and technically orientated skills such as programming, spreadsheets, file management and databases receive more attention at the secondary level.

It is also interesting to note that few schools place much emphasis on teaching learners how to use the Internet before the end of Grade 7. A mere 3% of schools indicated that this was taught in Grades 1–3 and only 11% teach it in Grades 4–7. A number of primary school teachers commented during interviews that, at the primary school level, Internet use mainly consists of the teacher downloading information and making the information available to the students through a network.

All areas of skill receive greater attention at the secondary level as indicated in Figure 6.2.2. It is particularly interesting to note the change in emphasis that takes place between Grades 8–10 and Grades 11–12. In comparison with the primary schools where basic computing principles receive more attention, only 38% of secondary schools indicated that these skills are taught to learners in Grades 8–10. This drops to 23% in Grades 11–12.

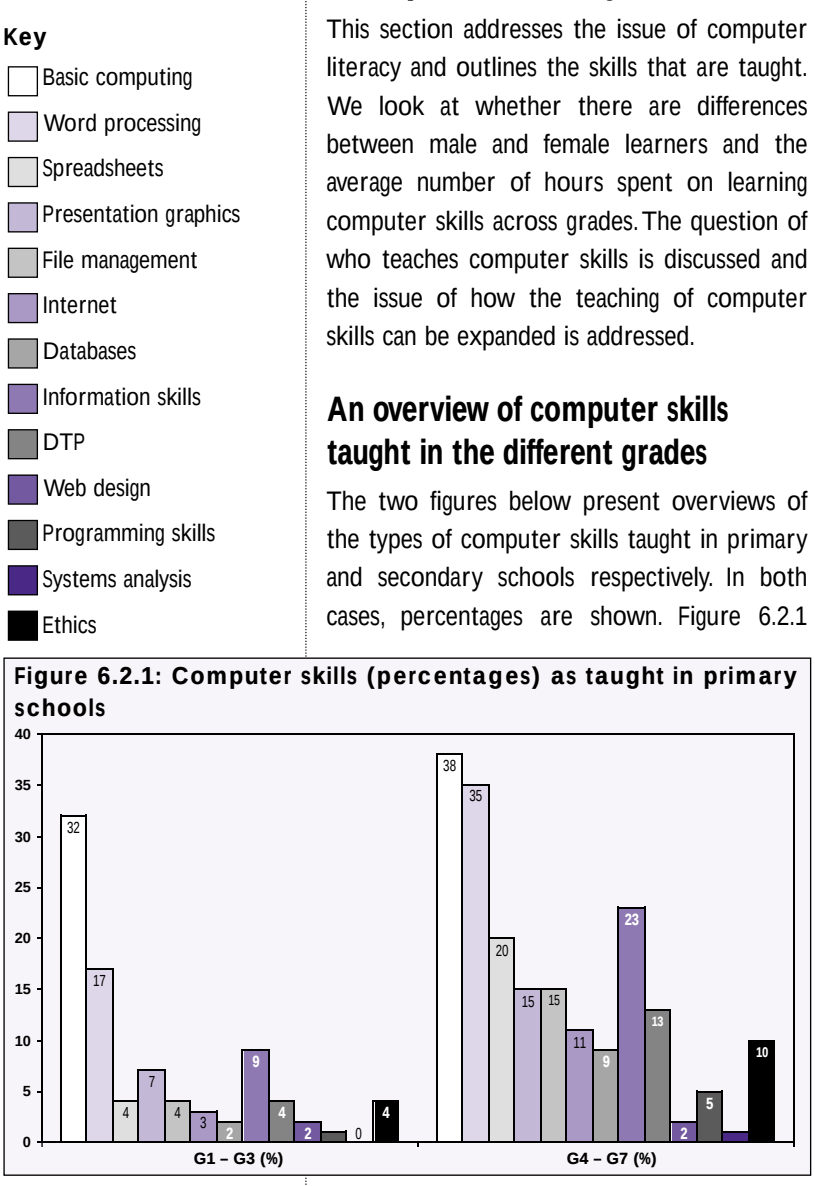


Figure 6.2.1: Computer skills (percentages) as taught in primary schools

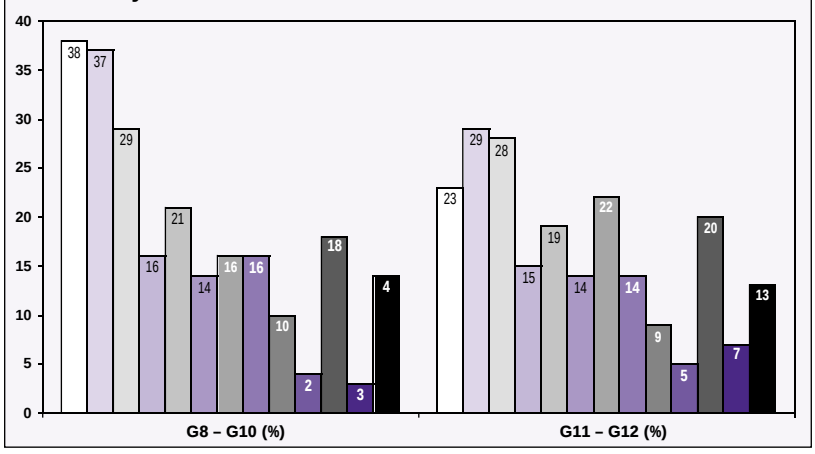


Figure 6.2.2: Computer skills (percentages) as taught in secondary schools

A similar picture is evident if the teaching of word processing skills is considered. It is interesting to see that 37% of schools indicated that they teach these skills in Grades 8–10 and 35% of schools teach this in Grades 4–7. Thus most schools focus on teaching word processing skills between Grades 4–10 and by the time learners reach Grade 11 they are expected to be competent in this area. The teaching of basic computer principles also happens mostly in Grades 4–10.

In looking at the two figures together, it is interesting to note that the area of information skills (which was explained to schools in the questionnaire as consisting of tasks such as research and exploration using CD-Rom and the Internet) receives the most prominence in Grades 4–7. While only 16% and 14% of schools indicated that this is addressed in Grades 8–10 and 11– 12 respectively, 23% of schools indicated that they taught these skills in Grades 4–7. Only 9% indicated that they focused on this area in Grades 1–3. Again it seems that the teaching of basic skills to equip learners to use computers as sources of information is emphasised by a number of schools in the late primary phase of schooling.

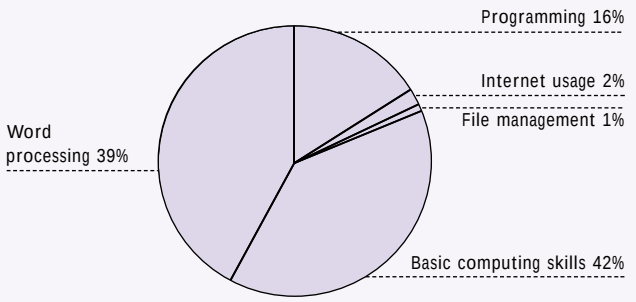
It seems therefore that Grades 4–7 is a critical stage for many schools in equipping learners with a number of the basic components in the efficient and effective use of computers, i.e. the principles of computing; word processing; and using computers for information gathering and research.

Another area of skill that appears to form part of the curriculum at all levels, is the ethics of computer use. Although the emphasis is greater at the secondary level, 4% of schools indicated that this area is already discussed in Grades 1–3.

The three types of skills identified by the majority of the respondents as being very important (Figure 6.2.3) are:

- Basic computing principles (42%).
- Word processing skills (39%).
- Programming skills (16%).

Figure 6.2.3: Ordering of most important computer skills for Grades 8–10 (First choice)



All other skills mentioned receive very little general support. This rank-ordering suggests that, although a large variety of computer skills are taught in secondary schools (see Figure 6.2.2), most respondents view these three types of skills as the core skills that should form part of all curricula.

Basic principles of computers as a key area of emphasis

The subject of 'basic computing' is the area of skill considered most important by the greatest percentage of respondents at both primary and secondary level (Figure 6.2.3). Further analysis revealed interesting results when this variable is cross tabulated with whether Computer Studies is offered as a school subject and the total number of computers at the school.

When the area of basic computing skills was considered in relation to whether schools taught Computer Studies, it was interesting to note that 67% of schools that teach Computer Studies indicated that the basic skills were taught in Grades 8–10. In comparison, only 19% of schools that do not teach Computer Studies teach basic computing skills at this level. The same picture is evident when looking at the Grades 11–12, but, in general, a smaller percentage of schools teach basic computer skills at this level. This confirms the change in emphasis in the Computer Studies curriculum between these two levels.

If the teaching of basic skills in Grades 8–10 is considered in relation to the number of computers which a school has (Table 6.2.1), the percentage of schools teaching these skills

Table 6.2.1: Basic computing principles by total number of computers

Total number of computers (categories)		Yes	No	Total
10 and less				
Basic computing principles (G1–G3)	Count	58	222	280
	%	21%	79%	100%
Basic computing principles (G4–G7)	Count	78	202	280
	%	28%	72%	100%
Basic computing principles (G8–G10)	Count	52	228	280
	%	19%	81%	100%
Basic computing principles (G11–G12)	Count	37	243	280
	%	13%	87%	100%
Between 11 and 29				
Basic computing principles (G1–G3)	Count	151	202	353
	%	43%	57%	100%
Basic computing principles (G4–G7)	Count	166	187	353
	%	47%	53%	100%
Basic computing principles (G8–G10)	Count	143	210	353
	%	41%	59%	100%
Basic computing principles (G11–G12)	Count	79	274	353
	%	22%	78%	100%
30 and more				
Basic computing principles (G1–G3)	Count	99	189	288
	%	34%	66%	100%
Basic computing principles (G4–G7)	Count	117	171	288
	%	41%	59%	100%
Basic computing principles (G8–G10)	Count	161	127	288
	%	56%	44%	100%
Basic computing principles (G11–G12)	Count	102	186	288
	%	35%	65%	100%

Figure 6.2.4: A comparison of proportion of male and female learners that are taught computer skills in primary schools

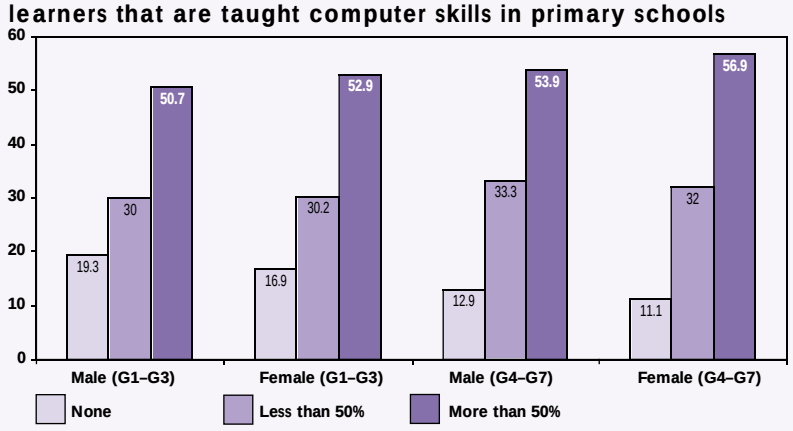
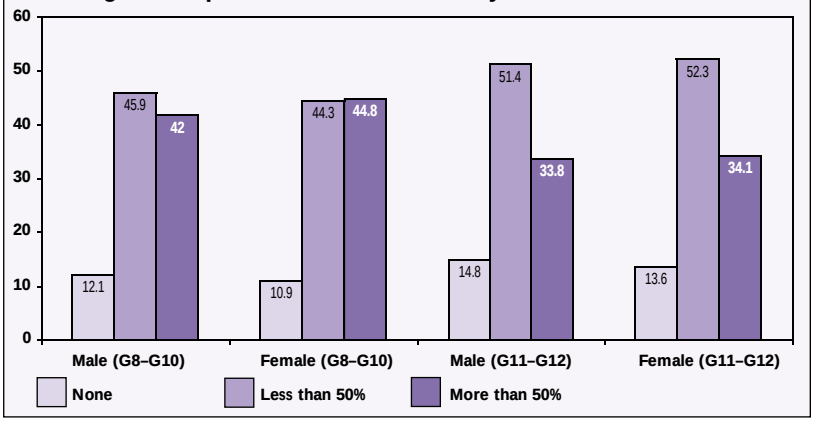


Figure 6.2.5: The proportion of male and female learners that are taught computer skills in secondary schools



increases as the number of computers increase (i.e. 19% for those with 10 or less, 41% for those with 11 to 29 computers and 56% of those with 30 computers or more). The evidence therefore shows that access to computers correlates with the teaching of basic computing skills to learners at this level.

Proportions of male and female learners that are taught computer skills

The following two figures compare male and female learners and the proportions of each group that is being taught computer skills in various grades.

In Grades 1 – 3 and Grades 4–7, there is very little difference between the percentage of male and female learners taught computer skills in schools. In both sets of grades, there are slightly more female learners than male learners in schools where over 50% of learners learn computer skills.

A similar picture can be seen in secondary schools with little difference being seen between the percentage of male and female learners taught computer skills among those schools where more than half learn computer skills and in schools where less than 50% learn computer skills. In general therefore, the evidence from the respondents shows that in the teaching of computer skills gender differences are statistically insignificant. This pattern did not yield any important changes when other variables such as level of computer resources were considered.

Average hours spent learning computer skills

The evidence from Table 6.2.2 shows that learning computer skills forms a very small part of the overall teaching and learning process in most primary schools from the sample. Learners in primary schools spend on average less than an hour per week learning computer

skills. The situation in secondary schools is slightly better: about 33% of learners spend between two and three hours a week learning computer skills, while 20% in Grades 8–10 and 34% in Grades 11–12 devote more than three hours per week to this.

Further analyses revealed that these profiles are generally true across provincial boundaries and geographical areas.

Two other factors seem to be more strongly relevant to the learning of computer skills: whether Computer Studies is taught as a subject and the number of computers in the school. The findings show in schools where Computer Studies is offered as a subject, larger proportions of learners get involved in learning computer skills. This pattern is evident across all grades at the secondary level and is most vividly illustrated at the highest level. Among schools that teach Computer Studies as a subject, 44% of learners from Grades 11–12 spend an average of three hours or more per week using computers. Among those that do not teach the subject, only 7% indicated the same amount of use at this level (i.e. three hours or more per week). The responses again show the important influence of Computer Studies as a school subject in all our analyses.

Another particularly important factor influencing the time spent, is the number of computers which a school has (Table 6.2.3).

If we look at Grades 11–12, where schools have up to 10 computers, 17% indicated that learners spent more than three hours per week learning computer skills. Where there are 11 to 29 computers, 32% of the schools indicated more than three hours is spent and among those with 30 computers or more, 42% indicated the same amount of time spent. A similar pattern is evident in Grades 8–10.

Of particular interest however is the fact that at the lower levels, a greater number of hours seem to be spent by learners in those schools with fewer resources. In schools with 10 computers or less, 5% indicated that learners in Grades 1–3 spent more than three hours a week on the computers and 4% indicated this for Grades 4–7. Among the schools with 11 to 29 computers, 2% and 3% respectively indicated such an amount of time spent by learners at these two levels. Where schools have 30 or more computers only 1% indicated this amount of time spent by learners in Grades 1–3 and 3% indicated the same for Grades 4–7.

This suggests strongly that time spent is influenced by the existence of Computer Studies as a subject in a school. This, in turn, means the presence of a relatively large number of

Table 6.2.2: Average hours spent learning computer skills

		0-1 hrs	2-3 hrs	> than 3 hrs	Total
Hours spent on comp skills (G1–G3)	Count	343	41	9	393
	%	87%	10%	2%	100%
Hours spent on comp skills (G4–G7)	Count	333	89	14	436
	%	76%	20%	3%	100%
Hours spent on comp skills (G8–G10)	Count	187	136	81	404
	%	46%	34%	20%	100%
Hours spent on comp skills (G11–G12)	Count	116	111	116	343
	%	34%	32%	34%	100%

Table 6.2.3: Average hours spent learning computer skills and the total number of computers at school

Total number of computers (categories)		0-1 hrs	2-3 hrs	> than 3 hrs	Total
10 and less					
Hours spent on comp skills (G1–G3)	Count	74	12	5	91
	%	81%	13%	5%	100%
Hours spent on comp skills (G4–G7)	Count	83	12	4	99
	%	84%	12%	4%	100%
Hours spent on comp skills (G8–G10)	Count	39	19	5	63
	%	62%	30%	8%	100%
Hours spent on comp skills (G11–G12)	Count	31	14	9	54
	%	57%	26%	17%	100%
Between 11 and 29					
Hours spent on comp skills (G1–G3)	Count	160	16	3	179
	%	89%	9%	2%	100%
Hours spent on comp skills (G4–G7)	Count	156	38	5	199
	%	78%	19%	3%	100%
Hours spent on comp skills (G8–G10)	Count	74	54	33	161
	%	46%	34%	20%	100%
Hours spent on comp skills (G11–G12)	Count	43	47	42	132
	%	33%	36%	32%	100%
30 and more					
Hours spent on comp skills (G1–G3)	Count	104	12	1	117
	%	89%	10%	1%	100%
Hours spent on comp skills (G4–G7)	Count	92	36	4	132
	%	70%	27%	3%	100%
Hours spent on comp skills (G8–G10)	Count	71	62	42	175
	%	41%	35%	24%	100%
Hours spent on comp skills (G11–G12)	Count	41	48	64	153
	%	27%	31%	42%	100%

Figure 6.2.6: Teacher teaching computer skills at school

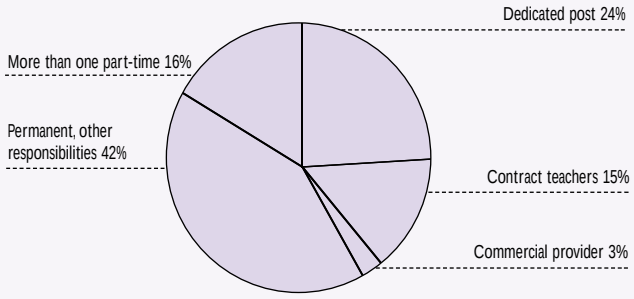


Table 6.2.4: A breakdown of the gender profiles of the people who mainly teach computer skills

	Teachers teaching computer skills						Total	
	Male		Female		> one teacher			
	Count	Row %	Count	Row %	Count	Row %	Count	Col %
Type of school								
Primary	89	26	227	66	29	8	345	46
Secondary	130	44	149	50	17	6	296	40
Combined	43	40	55	51	10	9	108	14
Province								
E/Cape	25	36	31	45	13	19	69	9
Free State	19	31	38	62	4	7	61	8
Gauteng	54	28	130	67	9	5	193	25
KZN	60	42	80	56	4	3	144	19
Mpumalanga	9	24	24	63	5	13	38	5
N/Province	2	18	8	73	1	9	11	1
N/Cape	13	46	12	43	3	11	28	4
North West	6	18	26	79	1	3	33	4
W/Cape	83	42	98	49	17	9	198	26
Geographical location								
Urban/towns	232	35	390	58	47	7	669	90
Peri-urban	6	32	13	68			19	3
Rural	27	47	24	42	6	11	57	8
School started to use computers actively								
Before 1990	85	35	133	55	22	9	240	32
1990 – 1994	101	35	165	57	22	8	288	38
1995 and after	77	35	134	60	12	5	223	30
Computer studies as a school subject								
Yes	135	36	222	59	17	5	374	49
No	134	35	214	55	38	10	386	51
Total number of computers (categories)								
10 and less	60	40	77	51	14	9	151	20
Between 11 and 29	122	36	188	56	25	7	335	44
30 and more	86	31	177	64	15	5	278	36
Total	**268**	**35**	**442**	**58**	**54**	**7**	**764**	**100**

computers. In primary schools with fewer resources there appears to be a tendency for learners to spend more time at the computers. This may relate to attempts to maximise the resources through sharing and group work to allow a greater number of learners some time in learning these skills. These processes may require more time from the timetable.

Profile of the computer skills teachers

Schools were asked to indicate who mainly teaches computer skills at the school. From Figure 6.2.6 it is clear that most schools (42%) employ a permanent member of the teaching staff who teaches computer skills as well as other subjects. Only 24% of schools employ a dedicated computer skills teacher. Significant proportions of schools employ either a full-time person contracted by the governing body (15%) or more than one permanent staff member on a part-time basis (16%). Some 3% of schools indicated that they have a person in a full-time capacity that works for a commercial provider.

The overall pattern that occurs across the sample is the prevalence of female teachers responsible for computer skills in the schools; 58% indicated a female teacher, 35% indicated a male teacher and 7% said that they have more than one teacher.

The prevalence of female teachers is most apparent in primary schools. Of the primary school respondents, 66% indicated that their computer teacher was female, whereas 26% indicated that they had a male computer teacher. Among the secondary schools, 50% indicated that they had a female computer teacher and 44% indicated that they had a male computer teacher. Similarly among the combined schools, 51% indicated a female teacher and 40% a male teacher.

While the number of computers does not seem to affect significantly the pattern of more female teachers, the percentage difference is highest among schools with 30 computers or more. Among these schools, 64% indicated that they had a female computer teacher whereas 31% indicated that they had a male teacher. While the evidence shows that there are more female teachers teaching computer skills in the schools, it will be shown in Section C that if the average ratio of male to female

teachers for the system across all subject areas is considered, the ratio of male to female teachers in this sector is slightly higher.

Factors that could help to extend the teaching of computer skills in schools

Respondents were asked to identify one factor that would help them to extend the teaching of computer skills at their school. As is evident from Figure 6.2.7, the factor identified by most respondents (46.1%) is increased time available to learn computer skills. This is followed by 30.7% of respondents indicating that a greater range of computer skills should be included in the curriculum and 16.1% saying that the depth of knowledge around computer skills already being taught should be improved. Just 5.6% said that more resources should be made available to schools.

A more detailed breakdown of these responses by grouping variables are presented in Table 6.2.5 below.

Figure 6.2.7: Factors that should be emphasised to extend the teaching of computer skills

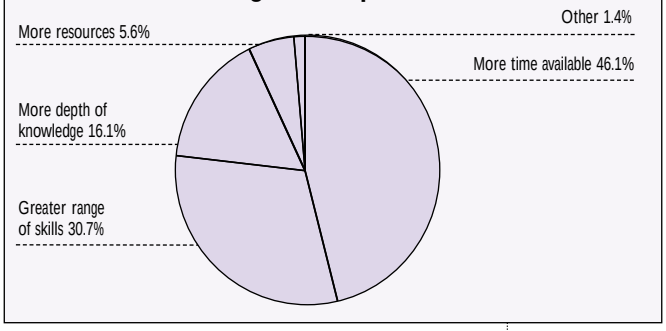


Table 6.2.5: Factor to be emphasised to extend the teaching of computer skills

	Extend teaching of computer skills								Total	
	Increase range		Improve depth		Increase time		Improve resources			
	Count	Row %	Count	Row %	Count	Row %	Count	Row %	Count	Col %
Type of school										
Primary	110	32	57	16	159	46	18	5	349	47
Secondary	83	29	45	16	138	48	18	6	286	39
Combined	32	31	15	15	46	45	6	6	102	14
Province										
E/Cape	17	25	17	25	26	38	7	10	69	9
Free State	13	25	7	13	29	55	1	2	53	7
Gauteng	62	33	27	14	92	49	6	3	189	25
KZN	33	24	24	18	64	47	12	9	137	18
Mpumalanga	12	31	7	18	19	49	1	3	39	5
N/Province	2	20	3	30	5	50			10	1
N/Cape	8	28	7	24	13	45	1	3	29	4
North West	17	49	5	14	11	31	2	6	35	5
W/Cape	70	35	26	13	91	46	13	7	200	26
Geographical location										
Urban/towns	199	31	107	16	299	46	38	6	652	89
Peri-urban	5	25	3	15	11	55			20	3
Rural	19	33	11	19	26	45	1	2	58	8
School started to use computers actively										
Before 1990	59	26	46	20	103	45	15	7	229	31
1990 – 1994	98	35	38	13	132	47	15	5	283	39
1995 and after	69	32	34	16	99	46	11	5	216	30
Computer studies as a school subject										
Yes	105	30	62	18	158	45	17	5	348	47
No	126	32	56	14	184	46	26	7	397	53
Total number of computers (categories)										
10 and less	59	36	17	10	74	45	12	7	165	22
Between 11 and 29	89	28	49	15	152	48	22	7	319	43
30 and more	80	31	56	21	117	45	7	3	261	35
Total	**228**	**31**	**122**	**16**	**343**	**46**	**41**	**6**	**745**	**100**

The overall pattern (Figure 6.2.7) does not differ much across the type of school.

- Primary schools: 46% identified time as the most important item to emphasise, 32% identified the need to increase the range of computer skills taught and 15% isolated the need to emphasise an improvement in the depth of knowledge that is taught in this area. Improving resources for the teaching of computer skills was seen as crucial by only 5% of the primary schools.
- Secondary schools: 48% identified time as the most important factor, with range of skills being identified by 29% and depth of knowledge by 16%. Only 6% of the secondary schools identified improving the level of resources as the main factor.
- Combined schools: 45% identified time as most important, 31% identified range of skills, 15% emphasised depth of knowledge and 6%, an improvement in resources.

Although similar patterns are evident across the nine provinces, it is interesting to note that 49% of schools from the North West province indicated that increasing the range of skills was most important. 31% of the schools from this province identified time as the most important factor. In all the other provinces, time was identified as the most important factor by most schools.

The significance of time as the most important factor to be emphasised in extending the teaching of computer skills does not appear to change in relation to when schools first started using computers. For schools that stated using computers before 1990, 45% isolated time as most important. Only 26% and 20% of these schools isolated range and depth respectively as most important. Among those schools that started using computers between 1990 and 1994, 47% indicated time as most important as compared to 35% identifying range and only 13%, depth of knowledge. The pattern remains the same for schools that started using computers after 1995 – 46% of these schools identified time as most important with 32% noting the importance of range of skills and 16% noting depth of knowledge.

It is also very interesting to note that the importance of time does not appear to diminish regardless of the number of computers that a school may have. Among those schools with 10 computers or less, 45% isolated time as most important in comparison to the 36% of these schools which identified range of skills as most important and the 10% that saw depth as the most critical factor. Similarly, among schools that have between 11–29 computers, 48% regarded time as most important, with 28% of the schools isolating range of skills and 15% noting the importance of depth of knowledge. Even where schools have 30 computers or more, 45% feel that time is most important for extending the teaching of computer skills, 31% feel that increasing the range of skills is most important and 21% feel that improving depth of knowledge is most essential.

While a higher proportion of schools in all of the three categories discussed above identified range above depth, it is interesting to note that as the number of computers in the school increases, the percentage difference between the identification of range above depth of knowledge decreases slightly. That is, among schools with 10 computers or less, 36% chose range as most important, with only 10% choosing depth of knowledge (a difference of 26%). Among schools with 11 to 29 computers, 28% chose range of skills and 15% chose depth of knowledge (a difference of 12%). Of those schools with 30 computers or more, 31% chose range of skills and 21% chose depth of knowledge as most important (a difference of only 10%). It seems therefore that, where schools have a larger number of available computers, there is a tendency for more consideration to be given to depth of knowledge as central to extending the teaching of computer skills.

Summary

- The sample data shows clearly that at both the primary and secondary level, the teaching of basic computer principles and word processing skills form the most substantial component of computer literacy teaching. At the same time, while all areas of skill are given greater attention at the secondary level, there is also a movement towards an increase in the level of complexity of the skills taught at secondary level. Thus skills such as spreadsheets, file management, database management as well as programming skills receive prominence at the secondary level. There is a close correlation between these trends and the teaching of Computer Studies at secondary school level.
- One of the most interesting patterns which arises from an assessment of what skills are taught at which level, is the predominance of Grades 4 – 10 in the teaching of both basic computer principles and word processing skills. This suggests that there is a tendency for schools to only start concentrating on these competencies from Grade 4 onwards. Similarly, by the time learners reach Grade 11 it is expected that a minimum level of competency in these areas would exist among most learners. It is also interesting to note that information skills, which include competencies such as using the computer for research via CD-Roms or the Internet, appear to receive the greatest prominence in Grades 4–7. Thus the data suggests that Grades 4–7 are regarded as a critical period in which learners are equipped with basic competencies for the efficient and effective use of computers.
- Although it has been suggested that a greater diversity and more complex skills are taught at secondary school level, it is important to note that when schools were asked to rank the most important skills for Grades 8 –10, basic computing principles and word processing still received the most support.
- A profile of the percentages of male and female learners who are being taught computer skills in the schools showed that in general there are no significant differences in the number of female learners that are taught computer skills in comparison to their male counterparts.
- The data shows that on average learners in primary schools spend less than one hour a week learning computer skills. At the secondary school level the time spent tends to increase but is significantly influenced once again by the offering of Computer Studies as a subject and the number of computers that a school has.
- At the secondary school level, as the number of computers increases so too do the number of hours spent by learners in the school. However, at the lower levels (primary level) the pattern appears to be the opposite with more time spent by learners at this level where there are fewer resources. It is suggested therefore that the offering of Computer Studies strongly influences time spent at the secondary level. However, at the primary school level it is shown that where resources are limited, more time is actually spent by the learners at the computers.
- When a profile was obtained of who is presently teaching computer skills in the school, the evidence showed that 42% of the schools employ a permanent member of the teaching staff to teach computer skills with this person also having additional responsibilities within the school. Only 24% indicated the presence of a teacher who has no other responsibilities at the school and is only responsible for computer teaching. Interestingly, the data shows that there is a dominance of female teachers compared to male teachers teaching computer skills. This is most apparent in primary schools as well as those that are well resourced.
- Of particular interest is the predominance of 'increased time available' as a factor that needs attention if the teaching of computer skills in schools is to be extended. This emphasis does not seem to diminish despite the number of computers which a school has or when they started using computers. 46% of schools indicated this factor as most important with 31% indicating that there was also a need to increase the range of computer skills taught. The need for a greater range of skills is given more prominence than increasing the depth of knowledge taught at both the primary and secondary level. While range still predominates over depth when other grouping variables were considered, it is interesting to note that the importance of depth is given slightly more attention among better resourced schools.

Computers in teaching and learning

One of the main aims of the survey was to establish whether, and to what degree, schools are integrating computers in teaching and learning. To this end a number of questions were asked pertaining to the following areas:

- The learning areas in which computers are used in teaching and learning
- The purposes for which computers are used in different grades
- Factors preventing schools from using computers as a teaching and learning tool

The learning areas in which computers are used in teaching and learning

Schools were asked to indicate in which of the current learning areas computers are used. As Table 6.3.1 below shows, there are rather large differences across learning areas with computers featuring prominently in Language and Mathematical Literacy, Natural Sciences and Technology but less so in the Humanities and Arts.

Table 6.3.1: Use of computers across learning areas

		Yes	No
Language Literacy	Count	520	442
	%	54	46
Mathematical Literacy	Count	505	457
	%	52	48
Natural Sciences	Count	245	717
	%	25	75
Technology	Count	443	519
	%	46	54
Human/Social Sciences	Count	209	753
	%	22	78
Economics	Count	95	867
	%	10	90
Arts and Culture	Count	112	850
	%	12	88
Life Orientation	Count	148	814
	%	15	85

A breakdown of learning areas where computers are used shows that they are used selectively according to the type of school. In fact, there are a range of learning areas where no more than one third of schools make use of computers in teaching and learning. Within primary schools the use of computers in teaching and learning tends to be emphasised for Language and Mathematical Literacy. Computers appear to be used less extensively in the remaining learning areas.

In secondary schools, more extensive use of computers in teaching and learning tends to occur in technology areas, such as Computer Studies. The remaining learning areas in secondary schools appear to be associated with lower levels of computer use.

A comparison between schools where Computer Studies is offered as a school subject and where it is not shows surprising differences in the use of computers in particular learning areas. For schools where Computer Studies exists as a school subject, the use of computers in teaching and learning is higher in Natural Sciences (32%) and Technology (81%). In schools where Computer Studies is not a school subject, the use of computers in the Natural Sciences and Technology is under 25%.

Interestingly however, while not very high, the use of computers in Language Literacy (58%) and Mathematical Literacy (57%) is higher in schools where Computer Studies is not offered as a school subject compared to schools were they are. This may also relate to the predominance of those learning areas in primary schools where Computer Studies is not taught. In schools where Computer Studies is a school subject, 52% use computers in Language Literacy and 49% use computers for Mathematical Literacy.

Respondents were also asked to prioritise two learning areas where learners make the most use of computers. The responses to both the first and second choices are presented in Figures 6.3.1 and 6.3.2.

Technology, Language and Mathematics were most often the first choices of learning areas in which learners make the most use of computers.

The second choice of learning areas that schools considered learners to be making the most use of computers were in Technology and

Table 6.3.2: Computer use in learning areas by school type

		Yes	No
Primary			
Language Literacy	Count	312	137
	%	69	31
Mathematical Literacy	Count	301	148
	%	67	33
Natural Sciences	Count	123	326
	%	27	73
Technology	Count	143	306
	%	32	68
Human/Social Sciences	Count	115	334
	%	26	74
Economics	Count	22	427
	%	5	95
Arts and Culture	Count	57	392
	%	13	87
Life Orientation	Count	79	370
	%	18	82
Secondary			
Language Literacy	Count	119	228
	%	34	66
Mathematical Literacy	Count	119	228
	%	34	66
Natural Sciences	Count	83	264
	%	24	76
Technology	Count	215	132
	%	62	38
Human/Social Sciences	Count	64	283
	%	18	82
Economics	Count	42	305
	%	12	88
Arts and Culture	Count	40	307
	%	12	88
Life Orientation	Count	47	300
	%	14	86
Combined			
Language Literacy	Count	72	50
	%	59	41
Mathematical Lliteracy	Count	68	54
	%	56	44
Natural Sciences	Count	32	90
	%	26	74
Technology	Count	70	52
	%	57	43
Human/Social Sciences	Count	25	97
	%	20	80
Economics	Count	22	100
	%	18	82
Arts and Culture	Count	12	110
	%	10	90
Life Orientation	Count	18	104
	%	15	85

Table 6.3.3: Use of computers across learning areas and the teaching of Computer Studies as a subject

		Yes	No
Computer Studies			
Language Literacy	Count	200	188
	%	52	48
Mathematical Literacy	Count	191	197
	%	49	51
Natural Sciences	Count	124	264
	%	32	68
Technology	Count	314	74
	%	81	19
Human/Social Sciences	Count	96	292
	%	25	75
Economics	Count	54	334
	%	14	86
Arts and Culture	Count	60	328
	%	15	85
Life Orientation	Count	71	317
	%	18	82
No Computer Studies			
Language Literacy	Count	305	217
	%	58	42
Mathematical Literacy	Count	297	225
	%	57	43
Natural Sciences	Count	112	410
	%	21	79
Technology	Count	122	400
	%	23	77
Human/Social Sciences	Count	103	419
	%	20	80
Economics	Count	39	483
	%	7	93
Arts and Culture	Count	49	473
	%	9	91
Life Orientation	Count	66	456
	%	13	87

Table 6.3.4: Computer use by learners

	Yes Count	No Count	Yes Percentage	No Percentage
Individual work G1–G3	205	757	21	79
Individual work G4–G7	214	748	22	78
Individual work G8–G10	226	737	36	77
Individual work G11–G12	237	725	25	75
Group work G1–G3	73	889	8	92
Group work G4–G7	68	894	7	93
Group work G8–G10	54	908	6	94
Group work G11–G12	29	933	3	97
Individual & Group G1–G3	133	829	14	86
Individual & Group G4–G7	187	775	19	81
Individual & Group G8–G10	122	840	13	87
Individual & Group G11–G12	96	866	10	90

Language, followed by Mathematics. This selection strengthens the priorities that schools put forward in their first choices.

The purposes for which computers are used in different grades

Computers are used for different purposes at different levels. Respondents were asked to indicate which of five possible purposes are relevant in their schools and at what grades. The overall responses are summarised in Figure 6.3.3, and the rank-ordering of priorities identified by schools are presented in Figure 6.3.4.

For Grades 1–3 and 4–7, drill and practice followed by problem-solving exercises remain the most important purpose for which computers are used. In Grades 8–12, computers tend to be used for a wider variety of purposes but these are dominated by presentation of assignments and problem-solving exercises. Although less prominent, computers continue to be used for drill and practice exercises in Grades 8–12.

Schools indicated that the most important purposes for which computers were used were for drill and practice, problem-solving and presentation of assignments. Almost 77% of schools chose one of these three options as the most important purpose for which computers are used.

The evidence in Table 6.3.4 suggests that learners across all grades use computers more for individual work (22–25% in all grades) than for either group work (3–8% in all grades) or individual and group work (10–19% across all grades).

The evidence shows that essentially, all learners, regardless of grade or the number of computers available, use computers more for individual work than for group work only or individual work and group work combined.

Figure 6.3.1: Learning areas in which learners make the most use of computers (First choice)

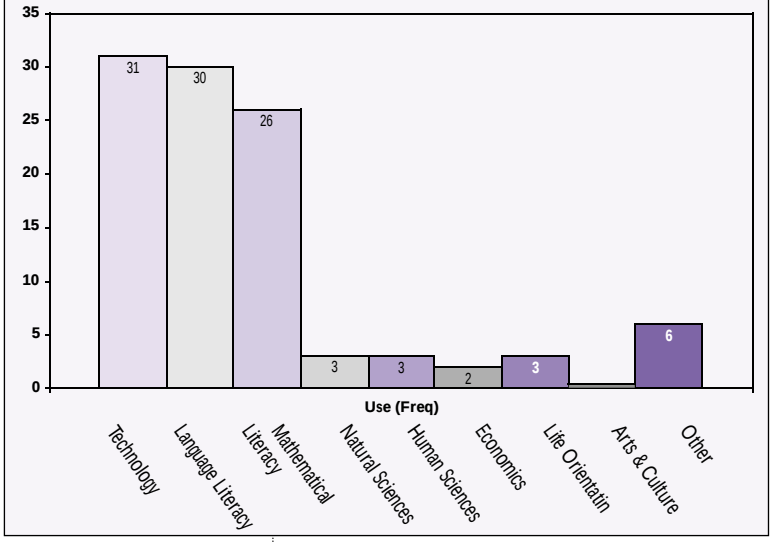
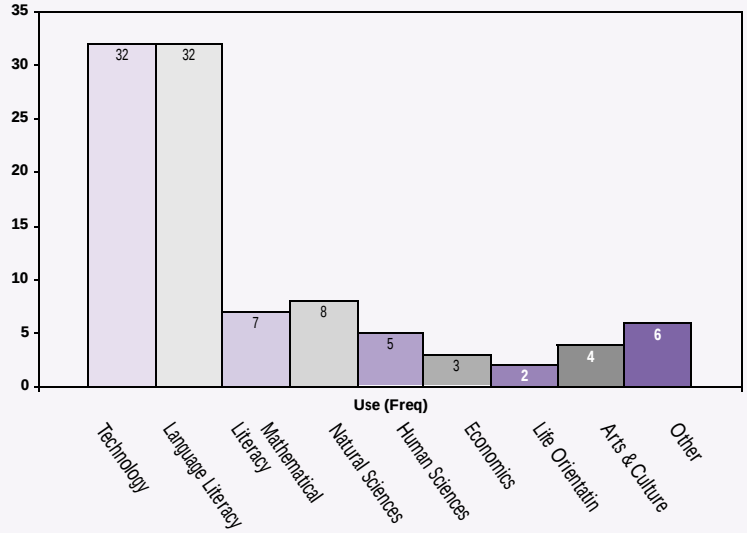


Figure 6.3.2: Learning areas in which learners make the most use of computers (Second choice)



Factors preventing schools from using computers in teaching and learning

In the questionnaire, respondents were first asked to tick off the factors that prevent schools from using computers in teaching and learning. The results are presented in Figure 6.3.5. The factors most often ticked off were insufficient funds, an insufficient number of computers, lack of computer literacy among

teachers, lack of subject teachers with training on how to integrate computers into specific learning areas and the absence of a properly developed curriculum for teaching computer skills.

Then respondents were asked to list, in order of priority, the most important factors preventing the use of computers as a teaching and learning tool. In answer to this, the main factors indicated were: insufficient funds, an insufficient number of computers at schools and a lack of computer literacy among subject teachers. This list was consistent with the factors identified in Figure 6.3.6.

Analysis of the data revealed that the factors listed as preventing schools from using computers as a teaching and learning tool is sharply influenced by the number of computers the school possesses. It can be observed in Figure 6.3.7 that schools that have 10 or fewer computers are faced with a greater intensity of inhibiting factors. The most prominent of these is insufficient funds and too few computers.

However, when a perceived lack of computer literacy among subject teachers was measured as a factor against the number of computers per school, the responses were in fact inverted. It appears to be comparatively, but not absolutely more observable that for schools with 30 or more computers a lack of computer literacy among teachers is seen as more of an obstacle.

Figure 6.3.3: Purposes for which computers are used in different grade levels

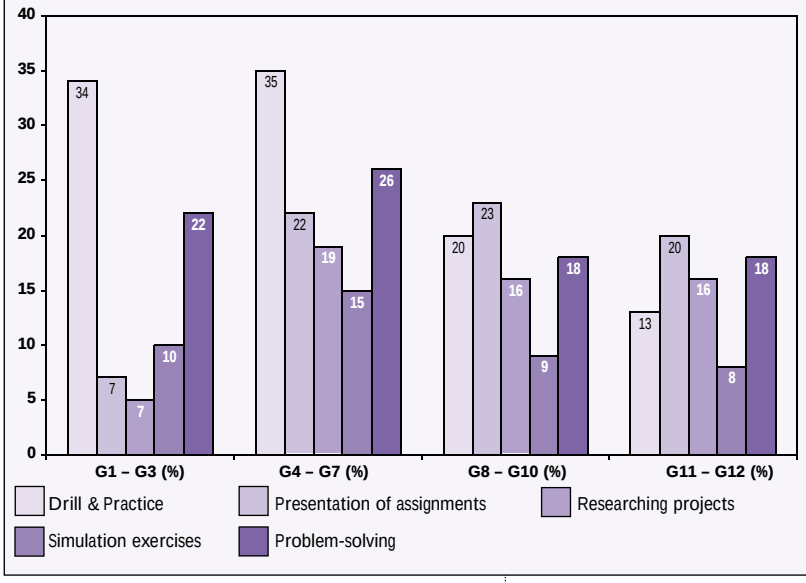


Figure 6.3.4: Prioritising of purposes for which computers are used by school type (first choice)

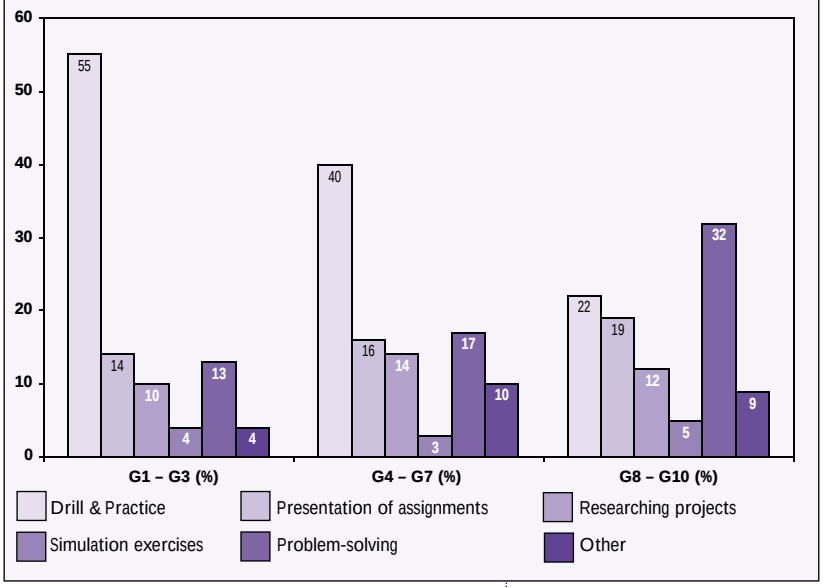


Figure 6.3.5: Factors that prevent schools from using computers as a teaching and learning tool

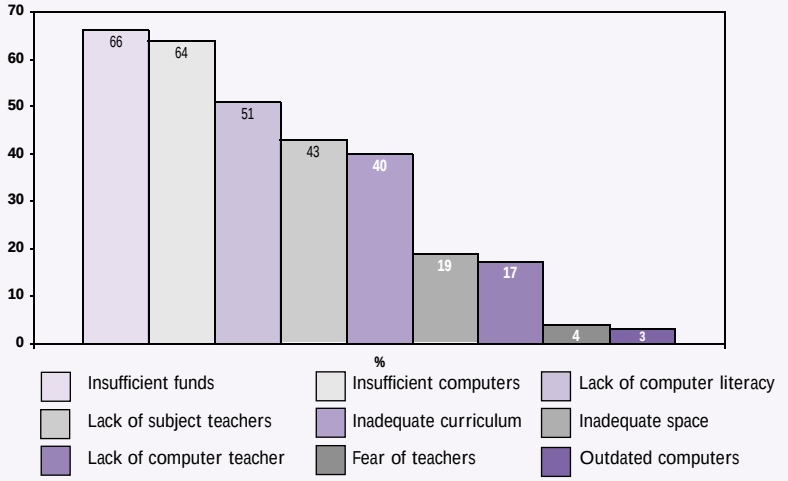


Figure 6.3.6: Rank ordering of main factors preventing schools from using computers as a teaching and learning tool (First choice)

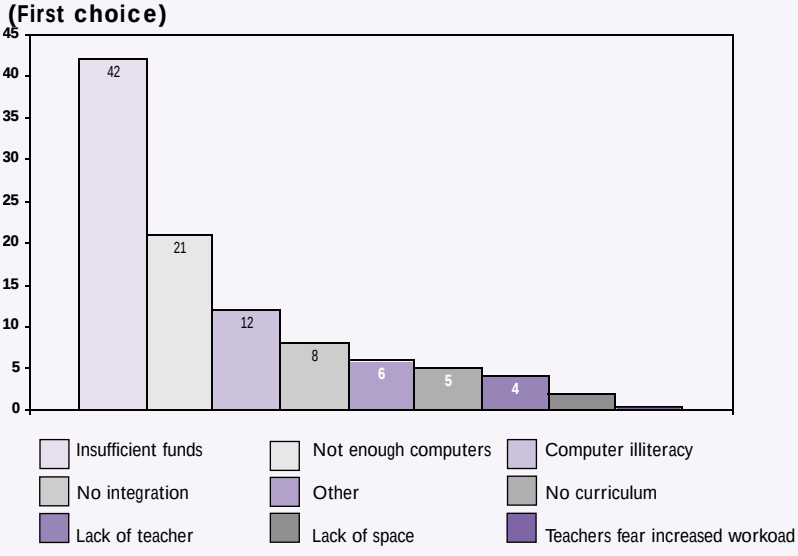


Figure 6.3.7: Rank ordering of factors preventing schools from using computers by total number of computers (First choice)

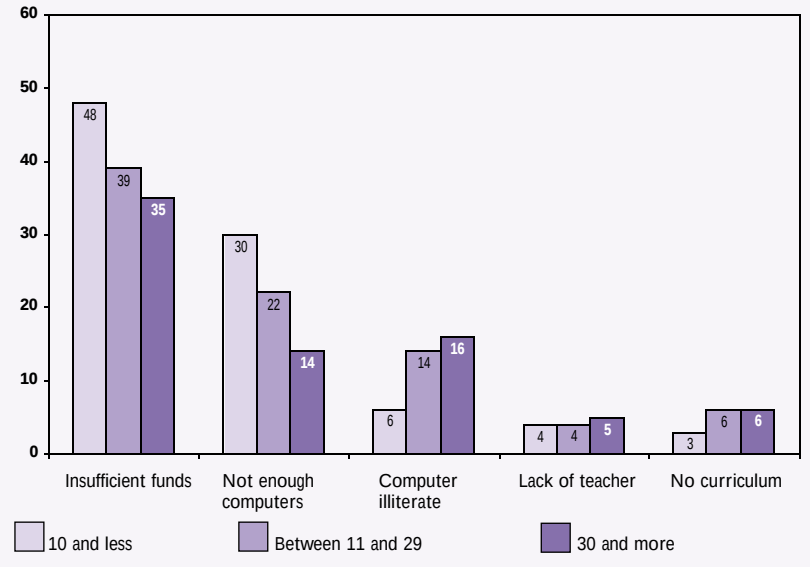


Table 6.3.5: Computer use by learners by total number of computers (Grades 1–7)

Total number of computers (categories)	Yes Count	No	Yes Percentage	No
10 and less				
Individual work G1–G3	42	238	15	85
Individual work G4–G7	50	230	18	82
Group work G1–G3	18	262	6	94
Group work G4–G7	21	259	8	93
Individual & Group G1–G3	29	251	10	90
Individual & Group G4–G7	33	247	12	88
Between 11 and 29				
Individual work G1–G3	87	266	25	75
Individual work G4–G7	88	265	25	75
Group work G1–G3	36	317	10	90
Group work G4–G7	27	326	8	92
Individual & Group G1–G3	67	286	19	81
Individual & Group G4–G7	96	257	27	73
30 and more				
Individual work G1–G3	74	214	26	74
Individual work G4–G7	73	215	25	75
Group work G1–G3	15	273	5	95
Group work G4–G7	15	273	5	95
Individual & Group G1–G3	36	252	13	88
Individual & Group G4–G7	57	231	20	80

Table 6.3.6: Computer use by learners by total number of computers (Grades 8–12)

Total number of computers (categories)	Yes Count	No	Yes Percentage	No
10 and less				
Individual work G8–G10	25	255	9	91
Individual work G11–G12	29	251	10	90
Group work G8–G10	9	271	3	97
Group work G11–G12	5	275	2	98
Individual & Group G8–G10	16	264	6	94
Individual & Group G11–G12	11	269	4	96
Between 11 and 29				
Individual work G8–G10	86	267	24	76
Individual work G11–G12	84	269	24	76
Group work G8–G10	19	334	5	95
Group work G11–G12	9	344	3	97
Individual & Group G8–G10	48	305	14	86
Individual & Group G11–G12	35	318	10	90
30 and more				
Individual work G8–G10	112	176	39	61
Individual work G11–G12	121	167	42	58
Group work G8–G10	24	264	8	92
Group work G11–G12	14	274	5	95
Individual & Group G8–G10	58	230	20	80
Individual & Group G11–G12	50	238	17	83

Summary

- The use of computers in primary and secondary schools tends to feature more strongly in the learning areas of Language, Mathematics, Natural Sciences and Technology, but less in the Humanities and Arts. This was affirmed when schools were asked to identify the learning areas in which learners make the most use of computers. In addition, the use of computers across the curriculum appears to be more extensive at schools where Computer Studies is offered as a school subject in the curriculum.
- The use of computers to perform drill and practice, and problem-solving exercises, tends to be the norm in the lower grades i.e. Grades 1–7. From Grade 8 upwards, computers tend to be used for a greater variety of purposes in the teaching and learning process, although the presentation of assignments and problem-solving exercises are the major uses to which computers at schools are put. However, drill and practice exercises using computers, although less prominent, are still used in Grades 8–12.
- In terms of the manner in which computer use is organised in the classroom, at most schools learners tend to use computers more for individual work than for group or collaborative work. This appears to be the case regardless of how many computers the school has.
- There are a number of factors that prevent schools from using computers as a teaching and learning tool. The principal ones are insufficient funds, an insufficient number of computers, lack of computer literacy among teachers, lack of subject teachers with training on how to integrate computers into specific learning areas as well as the absence of a properly developed curriculum for teaching computer skills. These factors have also been confirmed by a rank ordering provided by schools of specific institutional priorities. Schools that had less than 10 computers appeared to face a greater intensity of inhibiting factors. The most prominent of these were insufficient funds and an insufficient number of computers. Although insufficient funds and an insufficient number of computers were identified as factors preventing schools with 30 and more computers from using computers as a teaching and learning tool, a comparatively greater proportion of such schools listed the lack of computer literacy among subject teachers as a problem.

Computer Studies as a formal school subject

This section deals with 'Computer Studies' as a formal school subject that is taught mainly in Grades 8–12 and can be chosen as a matric subject. A profile of schools that offer Computer Studies is presented with variations according to province, geographical location and other variables. Areas of work covered in the subject are addressed and analysed according to the same variables. Then we look at the profile of teachers who teach the subject. And finally, responses that schools gave when asked why they believe the subject to be important are listed and analysed.

Table 6.4.1: Schools that teach Computer Studies

Computer studies at school	Yes		No		Total	
	Count	Row %	Count	Row %	Count	Col %
Type of school						
Primary	80	19	335	81	415	47
Secondary	224	66	115	34	339	39
Combined	74	61	47	39	121	14
Province						
E/Cape	19	25	58	75	77	8
Free State	28	38	45	62	73	8
Gauteng	107	48	116	52	223	25
KZN	99	60	65	40	164	18
Mpumalanga	19	40	28	60	47	5
N/ Province	8	50	8	50	16	2
N/Cape	7	20	28	80	35	4
North West	18	42	25	58	43	5
W/Cape	83	36	149	64	232	25
Geographical location						
Urban/towns	337	44	434	56	771	88
Peri-urban	13	48	14	52	27	3
Rural	23	30	53	70	76	9
School started to use computers actively						
Before 1990	135	53	122	47	257	30
1990 – 1994	144	42	196	58	340	40
1995 and after	93	36	168	64	261	30
Total number of computers (categories)						
10 and less	44	17	213	83	257	29
Bet. 11 & 29	158	46	185	54	343	39
30 and more	182	65	99	35	281	32
Total	**384**	**44**	**497**	**56**	**88**	**100**

Schools that offer Computer Studies

Table 6.4.1 summarises the responses of schools to whether or not they offer a subject that focuses on Computer Studies. Of the 881 schools that responded, 44% answered yes and 56% indicated that no such subject was offered.

As would be expected Computer Studies is mainly offered at the secondary level and therefore the responses from primary schools and secondary schools are very different. Of the primary schools who responded, only 19% indicated that they offer a subject of this nature, whereas 66% and 61% of the secondary and combined schools respectively indicated that they offer Computer Studies as a subject. It is likely that Computer Studies is offered as a matric subject by these schools. For the purposes of this study we have assumed that the primary schools that answered yes to this question are teaching a computer literacy subject but not the matric subject referred to here. In further analysis therefore we concentrated on the combined and secondary schools.

It is especially interesting to note the correlation between when schools started to use computers and those that teach Computer Studies. Prior to 1990 there was a strong link between the acquisition of computers and the offering of Computer Studies as a subject. Of the schools that started using computers prior to 1990, 53% indicated that they offer Computer Studies as a subject, whereas 47% indicated that they do not offer such a subject. Among schools that acquired computers between 1990 and 1994, 42% indicated that they offer Computer Studies, whereas 58% responded that they do not offer this subject. Where schools acquired computers after 1995, only 36% indicated that they offer Computer Studies as a subject and 64% indicated that they do not. Thus the percentage of schools offering Computer Studies in comparison with those who do not has decreased since 1990. Of the

schools that acquired computers after 1995, a larger proportion does not offer the subject.

The table also shows that the offering of Computer Studies as a subject goes hand in hand with a greater number of available computers. The responses indicated that of the schools with less than 10 computers, only 17% offer the subject and 83% do not. Where schools have between 11 and 29 computers, 46% of these indicated that they offer the subject and 54% indicated that they do not. However, of the schools that have 30 computers or more, 65% of these schools offer Computer Studies as a subject whereas 35% do not. The evidence suggests therefore that where Computer Studies is offered as a subject, the ratio of computers to learners is generally greater than in schools which do not offer the subject but where computers are used.

Areas of work covered in Computer Studies

The following tables present data on the areas of work covered by the subject of Computer Studies in Grades 8–10 and Grades 11–12 respectively.

In comparing Tables 6.4.2 and 6.4.3, it is interesting to note that among the schools that offer Computer Studies as a subject, there is a trend towards schools covering particular areas of work in Grades 8–10 and other areas of work in Grades 11–12. Of these schools, 72% indicated that they cover an introduction to computers in Grades 8–10, whereas only

1. Data presented for primary schools reflects the anomaly discussed earlier and therefore should be read with caution.

Table 6.4.2: Areas of work covered in Grades 8–10[1]

	Intro Computers		Basic Programming		Prog. Languages		Spreadsheets/ databases		Authoring		System analysis	
	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No
	Row %	Row %	Row %	Row %	Row %	Row %	Row %	Row %	Row %	Row %	Row %	Row %
Type of school												
Primary	23	78	6	94	5	95	15	85	5	95		100
Secondary	88	12	72	28	64	36	57	43	21	79	24	76
Combined	78	22	43	57	32	68	59	41	16	84	15	85
Province												
E/Cape	68	32	37	63	32	68	37	63	26	74	16	84
Free State	75	25	75	25	54	46	50	50	18	82	11	89
Gauteng	76	24	61	39	57	43	54	46	16	84	20	80
KZN	68	32	49	51	42	58	32	68	9	91	11	89
Mpumalanga	68	32	58	42	53	47	47	53	26	74	26	74
N/Province	63	38	50	50	25	75	38	63	25	75	25	75
N/Cape	57	43	43	57	29	71	29	71		100	14	86
North West	67	33	61	39	44	56	56	44	28	72	22	78
W/Cape	76	24	40	60	31	69	63	37	18	82	17	83
Geographical location												
Urban/towns	72	28	54	46	46	54	47	53	16	84	17	83
Peri-urban	54	46	38	62	31	69	31	69		100	8	92
Rural	83	17	48	52	35	65	65	35	22	78	13	87
School started to use computers actively												
Before 1990	72	28	60	40	52	48	50	50	13	87	17	83
1990 – 1994	78	22	56	44	48	52	51	49	17	83	19	81
1995 and after	67	33	40	60	30	70	43	57	22	78	15	85
Total number of computers (categories)												
10 and less	59	41	48	52	32	68	34	66	5	95	5	95
Between 11 and 29	68	32	46	54	38	62	40	60	18	82	13	87
30 and more	78	22	60	40	53	47	59	41	17	83	23	77
Total	**72**	**28**	**53**	**47**	**45**	**55**	**48**	**52**	**16**	**84**	**16**	**84**

37% indicated that these areas of work were dealt with in Grades 11–12. Similarly, 53% of these schools indicated that basics of programming is addressed in Grades 8–10 with only 42% indicating that these issues are covered in the higher grades. This suggests that in most cases where schools are offering Computer Studies as a subject, learners have developed an understanding of computers and have some knowledge of programming by the time they reach Grade 11.

The scenario changes when the other four areas of work are considered, i.e. programming languages, spreadsheets/databases, authoring and systems analysis. The tables show that, in general, more schools offer these four areas of work in Grades 11–12 than in Grades 8–10.

There are no significant differences in the areas of work covered if the responses are considered in relation to the grouping variables used throughout. However, it should be noted that among those schools with 10 computers or less, all areas of work are covered at all levels by a significantly smaller percentage of schools than among those schools with 30 computers or more. The one interesting exception however is in the area of introduction to computers at Grades 11–12. Among those schools with fewer resources, 45% indicated that they covered this area of work in the higher grades. However, among schools with 30 computers or more, 41% indicated that they covered this area at this level. It would seem therefore that the increased number of available computers allows for the

2. Data presented for primary schools reflects the anomaly discussed earlier and therefore should be read with caution.

Table 6.4.3: Areas of work covered in Grades 11–12[2]

	Intro Computers		Basic Programming		Prog. Languages		Spreadsheets/ databases		Authoring		System analysis	
	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No
	Row %	Row %	Row %	Row %	Row %	Row %	Row %	Row %	Row %	Row %	Row %	Row %
Type of school												
Primary	4	96	3	98	5	95	6	94	5	95	1	99
Secondary	45	55	58	42	79	21	85	15	29	71	44	56
Combined	51	49	41	59	46	54	65	35	22	78	30	70
Province												
E/Cape	42	58	47	53	63	37	58	42	37	63	32	68
Free State	29	71	50	50	54	46	82	18	36	64	32	68
Gauteng	36	64	43	57	65	35	66	34	21	79	37	63
KZN	34	66	48	52	58	42	57	43	14	86	30	70
Mpumalanga	32	68	42	58	58	42	58	42	16	84	26	74
N/Province	50	50	38	63	50	50	63	38	38	63	38	63
N/Cape	43	57	29	71	57	43	57	43	14	86	29	71
North West	50	50	67	33	72	28	83	17	33	67	39	61
W/Cape	41	59	28	72	39	61	63	37	25	75	27	73
Geographical location												
Urban/towns	36	64	44	56	58	42	66	34	23	77	33	67
Peri-urban/semi-towns	38	62	38	62	54	46	54	46	15	85	23	77
Rural	57	43	35	65	35	65	52	48	22	78	30	70
School started to use computers actively												
Before 1990	41	59	53	47	66	34	73	27	21	79	36	64
1990 – 1994	38	63	44	56	61	39	67	33	24	76	33	67
1995 and after	35	65	29	71	39	61	52	48	24	76	28	72
Total number of computers (categories)												
10 and less	45	55	39	61	34	66	43	57	7	93	9	91
Between 11 and 29	31	69	34	66	46	54	55	45	22	78	22	78
30 and more	41	59	50	50	70	30	76	24	26	74	46	54
Total	**37**	**63**	**42**	**58**	**56**	**44**	**64**	**36**	**22**	**78**	**32**	**68**

teaching of a greater range of subject areas from Grade 8–12.

A profile of Computer Studies teachers

Schools were first asked to indicate whether they have a specific teacher who is responsible for teaching Computer Studies. The responses are presented in Table 6.4.4. A subsequent question was asked to establish the gender of such a teacher. An analysis of these responses is summarised in Table 6.4.5.

In responding to the question of whether the school has a specific teacher responsible for Computer Studies, 92% of the schools indicated that they do have such a teacher. Of the secondary and combined schools that responded, 95% and 93% respectively said that they had a specific teacher responsible for Computer Studies.

It appears from the data that the presence of a dedicated teacher responsible for Computer Studies is not significantly affected by how long a school has had computers. Among those schools that started using computers before 1990, 92% indicated that they do have such a teacher and 8% indicated that they do not. Of those schools that started using computers between 1990 and 1994 and those who acquired them after 1995, the percentage differences are very similar to the previous category.

The presence of a specific teacher responsible for teaching Computer Studies also appears to be influenced by the number of computers that a school has. Of those schools that have 10 computers or less, 87% have a specific teacher responsible for teaching such a subject whereas 13% do not. The picture is the same for schools with 11–29 computers. Among the group of schools with 30 computers or more, 97% indicated that they had a specific teacher for Computer Studies while only 3% specified that they did not have a specific teacher for this purpose.

Table 6.4.4: Does the school have a specific teacher responsible for Computer Studies?[3]

Dedicated computer studies teacher		Yes		No	
		Count	Row %	Count	Row %
Type of school					
	Primary	60	85	11	15
	Secondary	210	95	12	5
	Combined	68	93	5	7
Province					
	E/Cape	15	79	4	21
	Free State	25	89	3	11
	Gauteng	100	96	4	4
	KZN	88	91	9	9
	Mpumalanga	18	100		
	N/Province	8	100		
	N/Cape	6	100		
	North West	16	89	2	11
	W/Cape	69	88	9	12
Geographical location					
	Urban/towns	300	92	26	8
	Peri-urban/semi-towns	13	100		
	Rural	18	82	4	18
School started to use computers actively					
	Before 1990	119	92	10	8
	1990 – 1994	130	93	10	7
	1995 and after	84	91	8	9
Total number of computers (categories)					
	10 and less	34	87	5	13
	Between 11 and 29	133	87	20	13
	30 and more	175	97	5	3
Total		**342**	**92**	**30**	**8**

If the data presented in Table 6.4.4 and in Table 6.4.1 is correlated, there is a particularly strong relationship between the presence of 30 or more computers, the offering of Computer Studies as a subject and the existence of a dedicated teacher for teaching this subject.

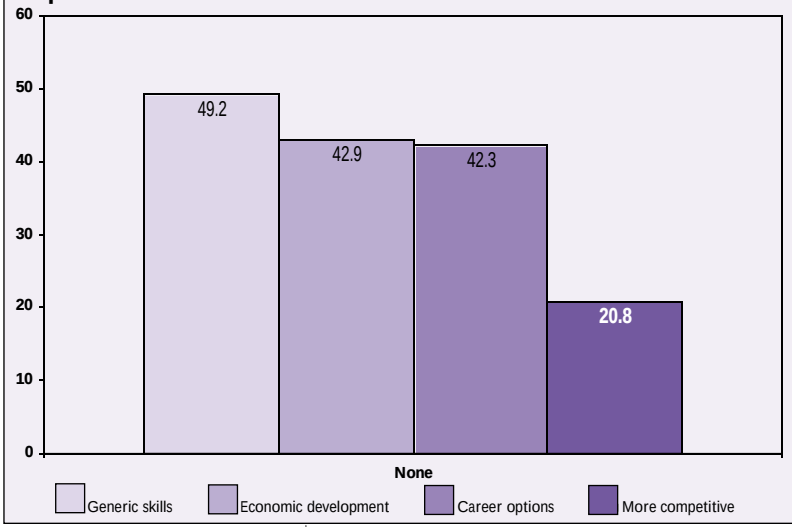
As with the general teaching of computer skills in schools, there are more female teachers than males teaching Computer Studies among the sample of schools from the survey. Table 6.4.5 shows that 58% of the respondents indicated that their Computer Studies teacher was female whereas 39% of the respondents indicated that the teacher was male. This pattern does not change significantly across the provinces, with the only province showing a higher percentage of male Computer Studies teachers among the respondents being the Eastern Cape (56% male and 31% female).

3. In primary schools this is likely to refer to the teacher responsible for a subject taught on computer literacy.

Table 6.4.5: Gender of Computer Studies teachers[4]

	Male		Female		M&F teachers	
	Count	Row %	Count	Row %	Count	Row %
Type of school						
Primary	16	27	42	70	2	3
Secondary	86	41	118	56	6	3
Combined	29	42	37	54	3	4
Province						
E/Cape	9	56	5	31	2	13
Free State	10	40	13	52	2	8
Gauteng	30	30	65	65	5	5
KZN	43	48	46	51	1	1
Mpumalanga	3	17	15	83		
N/Province	2	25	6	75		
N/Cape	2	33	4	67		
North West	4	25	12	75		
W/Cape	31	45	37	54	1	1
Geographical location						
Urban/towns	116	38	176	58	10	3
Peri-urban/semi-towns	5	38	8	62		
School started to use computers actively						
Before 1990	47	39	67	56	5	4
1990 – 1994	49	37	81	61	2	2
1995 and after	34	40	47	55	4	5
Total number of computers (categories)						
10 and less	17	50	16	47	1	3
Between 11 and 29	51	38	80	59	5	4
30 and more	65	37	105	60	5	3
Total	**133**	**39**	**201**	**58**	**11**	**3**

Figure 6.4.1: Reasons given for why Computer Studies is important



Similarly, no significant variations are evident if the start-up date for computers is considered. Some slight variations are evident if the number of computers owned by the school is considered. For those schools with 10 computers or less, 50% indicated that they had a male Computer Studies teacher while 47% indicated the employment of a female Computer Studies teacher. For those schools with 11 computers or more the profile changes once again to a greater percentage of female Computer Studies teachers. If the 11-29 computers group and the over 30 computers group are looked at comparatively, it seems that the percentage difference between the number of schools with male teachers decreases as the number of computers increase.

Reasons for offering Computer Studies as a subject

In requesting schools to consider the importance of offering Computer Studies as a subject, no single reason stands out significantly above the others. This suggests that schools are of the opinion that there are a number of benefits to offering learners the option of Computer Studies as a subject. These benefits range from the kind of skills which they will acquire through this learning area as well as the opportunities which such skills will open up for them with regard to future job prospects and their contribution to the country as a whole.

Least important to most of the respondents was the offering of Computer Studies as a way of making the school more attractive to other schools (only 21% indicated that Computer Studies was important for this reason). It is also important to note that almost half (49%) of the schools offering the subject note the importance of Computer Studies as providing learners with skills which they will be able to use or will be required to use in their careers. Thus it seems that many schools feel that teaching Computer Studies contributes to a necessary level of computer competency among learners once they leave the school. This aspect was particularly emphasised by those schools with 30 computers or more (87% indicated the importance of these skills for a range of career options).

4. Note previous caution with regard to primary schools.

Summary

- From the respondent sample, 66% of secondary schools indicated that they offered Computer Studies as a subject whereas 34% indicated that no such subject was offered despite the presence of computers in their schools.
- As can be expected, Computer Studies, as a formal subject, is largely offered by secondary schools and where such a subject is offered there are similar patterns among the schools regarding the areas of work covered in Grades 8–10 and Grades 11–12. In general the trend is towards introducing learners to computers and developing an understanding of the basics of programming in Grades 8–10 and then moving on to more specialised skills such as programming languages in Grades 11 and 12.
- The evidence from the research findings again suggests that a correlation exists between the offering of Computer Studies as a subject and the presence of a greater number of computers in the school. Stated in another way, within schools that offer Computer Studies as a subject, the ratio of computers to learners is generally greater than schools that do not offer the subject but where computers are used. However, it is important to recognise that this ratio may be skewed if the computers are primarily used by learners who take Computer Studies as a subject and are not used much by other learners in the school.
- The profiling of schools offering Computer Studies also shows a clear pattern with regard to when schools acquired computers and the offering of the subject. More specifically, the data shows that where schools acquired computers prior to 1990, there appears to have been a strong link between purchasing the computers and offering Computer Studies as a subject. It is interesting to note however that this pattern appears to have altered over the last nine years. Comparing the percentage of schools that offer Computer Studies with those that do not and grouping them according to when they started using computers shows interesting changes. While prior to 1990 there was a greater percentage of schools offering the subject compared to those that did not but still had computers, after 1990 the greater percentage of schools are those which have computers but which do not offer Computer Studies as a subject.
- The offering of Computer Studies also goes hand in hand with the presence of a specific teacher responsible for this subject. Once again the data obtained from this profile adds to the growing sense that the offering of Computer Studies as a school subject has had a significant influence on the level of computer resources at a school and the presence of a dedicated teacher responsible for this area of teaching and learning.
- As with the teaching of computer skills more generally, there is a predominance of female Computer Studies teachers among the sample of schools. Of these schools, 58% indicated the presence of a female teacher compared to 39% with a male teacher (the remaining schools had both a male and female teacher for this area).

Funding and maintenance

This section explores sources of funding for computers, including peripherals (such as printers, modems, etc.) and maintenance costs, and it examines the sort of priority these items receive in school budgets. It also provides insights into the people responsible for managing school computers as well as those assigned to provide maintenance and technical support for this equipment.

Table 6.5.1: Does the school have a specific budget for computers?

	Computer budget		Total	
	Yes	No		
	Row %	Row %	Count	Col %
Type of school				
Primary	73	27	434	48
Secondary	77	23	346	38
Combined	62	38	126	14
Province				
E/Cape	72	28	82	9
Free State	66	34	74	8
Gauteng	85	15	233	25
KZN	68	32	164	17
Mpumalanga	78	22	50	5
N/ Province	33	67	18	2
N/ Cape	59	41	34	4
North West	77	23	44	5
W/Cape	67	33	242	26
School started to use computers actively				
Before 1990	81	19	266	30
1990 – 1994	72	28	352	40
1995 and after	71	29	271	30
Geographical location				
Urban/towns	74	26	798	88
Peri-urban/semi-towns	65	35	26	3
Rural	57	43	79	9
Computer studies as a school subject				
Yes	84	16	383	42
No	65	35	519	58
Total number of computers (categories)				
10 and less	45	55	271	30
Between 11 and 29	78	22	352	39
30 and more	94	6	287	32
Total	**73**	**27**	**910**	**100**

Computer budget

Over 70% of schools that returned questionnaires indicated that they have a specific budget for computers. However, there were some variations in this trend.

- Only 33% of schools in the Northern Province (6 out of 18) indicated that they had computer budgets.
- Fewer rural schools (57%), than urban schools (74%) had a specific budget for computers.

In addition, there appears to be a direct relationship between the number of computers a school has and the existence of a dedicated budget for computers. Nearly 80% of schools that had between 11 and 29 computers, and over 90% of schools which had 30 or more computers, had a specific budget for computers. This was in sharp contrast to the schools that had up to 10 computers of which only 45% indicated that they had a specific budget for computers.

Table 6.5.2 shows items of computer expenditure at schools over the last two years. From this it can be seen that nationally the most important items were the purchase of new computers (53%), purchase of new software (58%) and the maintenance of computers (66%).

These patterns of expenditure were generally constant across the types of school and the different provinces, although the proportion of schools in the Northern Cape that purchased new computers (33%) or upgraded existing computers (28%) was below the national average. In the Northern Province, lower than average expenditure was recorded for new software purchases (26%) and maintenance (32%).

Expenditure on resources showed a considerable difference between schools that had 10 or fewer computers where it was comparatively low; and schools which had 30 or more computers where it was

comparatively high. Schools that started using computers before 1990, or offered Computer Studies as a school subject, also recorded high expenditure for new computers and software.

Sources of funding

The two most important sources of funding for computer resources are allocations from school fees and fundraising activities. A larger proportion of primary schools (52%) than secondary schools (33%) finance new computer resources through school fundraising activities. The converse is true of school fees. A higher proportion of secondary

Figure 6.5.1: Rank-ordering of items which received the most funding (First option)

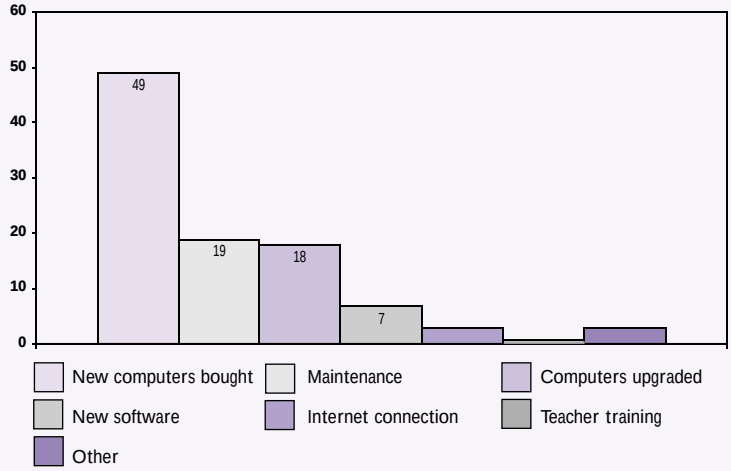
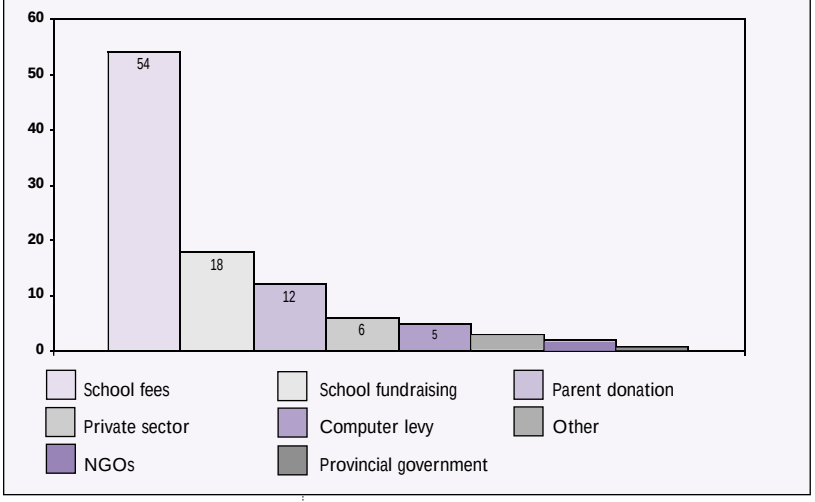


Table 6.5.2: Expenditure items on school computer budgets for the last two years

	New compters bought		Upgrade exist. compters		New software bought		Teacher training		Maintenance of compters		Internet connection		Total
	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	
	Row %	Row %	Row %	Row %	Row %	Row %	Row %	Row %	Row %	Row %	Row %	Row %	Count
Type of school													
Primary	47	53	40	60	57	43	20	80	64	36	26	74	446
Secondary	60	40	47	53	58	42	20	80	70	30	34	66	350
Combined	46	54	33	67	50	50	22	78	57	43	31	69	127
Province													
E/Cape	49	51	43	57	59	41	28	72	63	37	27	73	82
Free State	42	58	44	56	49	51	12	88	56	44	23	77	77
Gauteng	64	36	52	48	68	32	25	75	77	23	38	62	235
KZN	49	51	35	65	52	48	17	83	59	41	28	72	168
Mpumalanga	52	48	38	62	62	38	18	82	72	28	20	80	50
N/Province	37	63	32	68	26	74	16	84	32	68	5	95	19
N/Cape	33	67	28	72	36	64	11	89	58	42	22	78	36
North West	53	47	38	62	53	47	13	87	71	29	13	87	45
W/Cape	48	52	38	62	54	46	21	79	60	40	32	68	250
School started to use computers actively													
Before 1990	63	37	49	51	66	34	27	73	72	28	40	60	267
1990 – 1994	50	50	44	56	56	44	20	80	70	30	27	73	353
1995 and after	49	51	37	63	55	45	15	85	58	42	25	75	278
Geographical location													
Urban/towns	54	46	44	56	60	40	21	79	67	33	30	70	810
Peri-urban/semi-towns	39	61	39	61	43	57	14	86	57	43	25	75	28
Rural	34	66	26	74	35	65	11	89	45	55	19	81	85
Computer studies as a school subject													
Yes	67	33	53	47	65	35	24	76	77	23	43	57	388
No	42	58	34	66	52	48	17	83	58	42	21	79	524
Total number of computers (categories)													
10 and less	25	75	19	81	31	69	9	91	36	64	8	92	280
Between 11 and 29	53	47	44	56	60	40	19	81	71	29	30	70	355
30 and more	79	21	64	36	82	18	34	66	90	10	51	49	288
Total	**53**	**47**	**42**	**58**	**58**	**42**	**21**	**79**	**66**	**34**	**30**	**70**	**923**

1. A computer levy refers to the additional levy specifically for computers that is added on to the school fees. Essentially the parents are the source of funding.

Figure 6.5.2: The most important sources of funding for computer equipment[1]



schools (72%) than primary schools (60%) fund new computer resources through school fees.

75% of schools that offer Computer Studies as a school subject fund new computer resources through allocation of school fees, whereas 57% of schools where Computer Studies is not offered use fees to buy equipment. School fees, as a source of funds plays a bigger role as the number of computers at a school increases. Less than half of schools (41%) which have 10 or less computers finance new computer resources through fees. The importance of school fees as a source of financing new computer resources increases to 67% for schools that have between 11 and 29

Table 6.5.3: Funding sources for new computer resources at the school

	Parent donation		Provincial government		Private sector		NGOs		School fees		Computer levy		School fundraising		Total
	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	
	Row%	Row %	Row %	Row %	Row %	Row %	Row %	Row %	Row %	Row %	Row %	Row %	Row %	Row %	Count
Type of school															
Primary	23	77	0	100	15	85	2	98	60	40	10	90	52	48	446
Secondary	16	84	4	96	13	87	3	97	72	28	16	84	33	67	350
Combined	30	70	5	95	19	81	5	95	57	43	16	84	42	58	127
Province															
E/Cape	23	77		100	7	93	2	98	60	40	9	91	49	51	82
Free State	22	78	5	95	14	86	3	97	62	38	16	84	39	61	77
Gauteng	22	78	2	98	13	87	1	99	75	25	16	84	47	53	235
KZN	18	82	3	97	15	85	2	98	59	41	9	91	38	62	168
Mpumalanga	16	84		100	18	82	6	94	62	38	12	88	42	58	50
N/Province	16	84	16	84	5	95		100	42	58	5	95	26	74	19
N/Cape	25	75	3	97	11	89	3	97	58	42	19	81	28	72	36
North West	18	82		100	18	82	9	91	64	36	11	89	51	49	45
W/Cape	23	77	2	98	17	83	3	97	58	42	12	88	47	53	250
Geographical location															
Urban/towns	21	79	2	98	14	86	2	98	66	34	13	87	45	55	808
Peri-urban	18	82	7	93	18	82	7	93	61	39	18	82	25	75	28
Rural	24	76	3	97	16	84	6	94	43	57	8	92	41	59	87
School started to use computers actively															
Before 1990	22	78	2	98	11	89	1	99	75	25	15	85	42	58	266
1990 –1994	21	79	2	98	15	85	2	98	65	35	12	88	46	54	353
1995 and after	23	77	3	97	18	82	4	96	57	43	12	88	47	53	277
Computer studies as a school subject															
Yes	22	78	3	97	12	88	2	98	75	25	20	80	42	58	388
No	21	79	2	98	17	83	3	97	57	43	8	92	46	54	522
Total number of computers (categories)															
10 and less	20	80	5	95	15	85	3	97	41	59	3	98	40	60	280
Between 11 and 29	22	78	1	99	16	84	2	98	67	33	16	84	47	53	353
30 and more	22	78	1	99	13	88	2	98	84	16	20	80	46	54	288
Total	**21**	**79**	**2**	**98**	**15**	**85**	**2**	**98**	**64**	**36**	**13**	**87**	**45**	**55**	**921**

computers and to 84% for schools where there are 30 or more computers.

The bar chart in Figure 6.5.2 shows that the most important sources of funding that schools receive to finance computer resources at schools are, in order of rank, school fees, school fundraising activities and financial donations from parents.

In order of priority, the most important sources of funding for the support and maintenance of the use of computers at schools are through school fees, school fundraising activities and computer levies.

At most of the schools, maintenance of the computer equipment is undertaken largely by private professionals/commercial providers and by a teacher or teachers assigned to this task. At a much smaller though significant number of schools, the school principal and parents of school pupils also carry out this function (Figure 6.5.4).

The vast majority of schools in the survey had assigned the overall responsibility for managing the computers, including planning, budgeting, and acquiring equipment to teachers at the school. Just under one third of the schools surveyed had Principals who played this managing role (Figure 6.5.5).

Figure 6.5.3: Sources of funding for support and maintenance of computer equipment

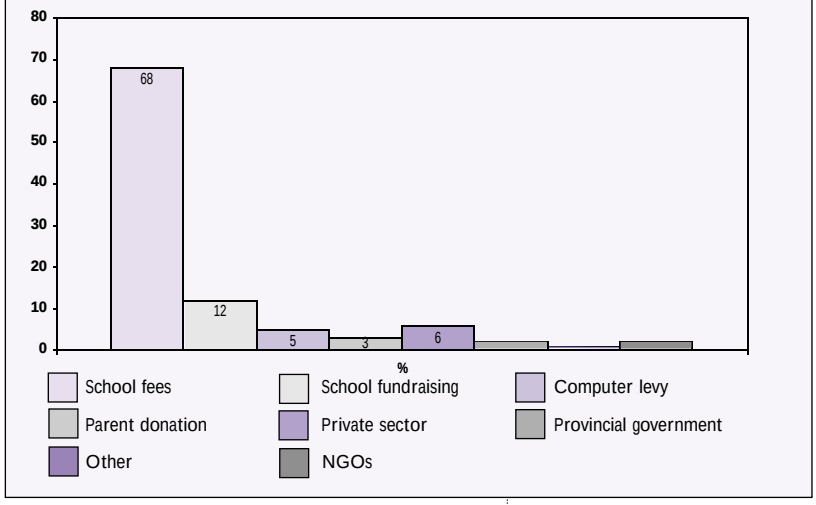


Figure 6.5.4: Person/group who mainly provides maintenance and technical support for school's computers

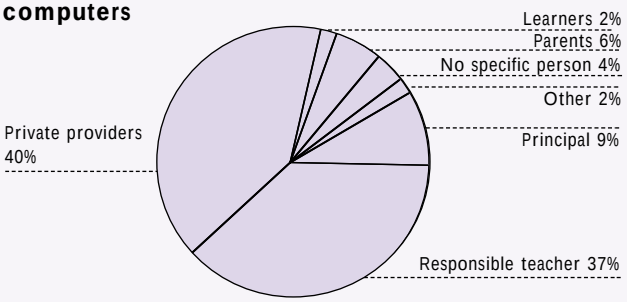
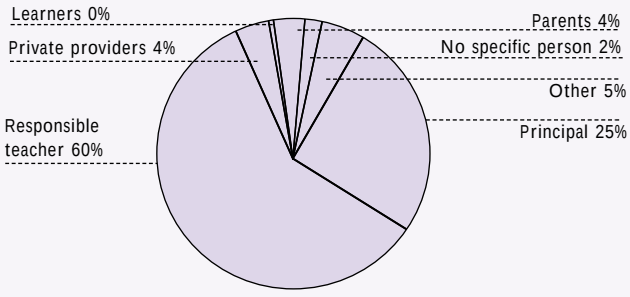


Figure 6.5.5: Person/group who is mainly responsible for managing the school's computers



Summary

- The majority of schools with computers (73%) indicated that they have a specific budget for computers, but such budgetary allocations were more prevalent at schools that have more than 10 computers.
- The most important items of expenditure on the computer budgets of schools in all provinces were the purchase of new computers, the purchase of software and the maintenance of computers. Schools that started using computers before 1990 or that offer Computer Studies as a school subject or had 30 or more computers tend to spend more on new computers and software. When schools were asked to rank the items that received the most funding, their list contained different combinations of the following: purchase of new computers, maintenance of computers, purchase of new software and upgrading of computers.
- There are multiple sources from which schools derive funding for new computer resources. The main sources are allocations from school fees and school fundraising activities and donations from parents and the private sector.
- At primary schools fundraising activities are almost as important as school fees as a source of funding for computer resources. At secondary schools, school fees are a more significant source of finance, but fundraising activities nonetheless continue to play an important role.
- At schools where Computer Studies is offered as a school subject, school fees play a bigger role as a source for the funding of computer resources. Similarly, school fees assume greater importance as a revenue source as the number of computers increases at a school.
- The revenues generated to cover maintenance and technical support of computers follows similar trends to those observed for the financing of new resources. The evidence shows that the most important sources of funding for the support and maintenance of computers are school fees, school fundraising activities and computer levies.
- Private professionals or commercial providers and either a teacher or teachers usually undertake maintenance and technical support.
- At most schools the people who are mainly responsible for managing the computers are teachers assigned this task. Principals quite often also take on this role.

The school-computer context

This section covers a broad range of issues within schools that may impact on computer use. The following areas are addressed:

- teacher attitudes to computers
- start-up date and reasons for beginning to use computers
- computer use in schools – prioritisation
- a profile of users
- expenditure planned over the next two years
- technology-related professional development of teachers
- computer-related training needs
- conditions underlying the use of computers in schools
- factors limiting access to the Internet

Teacher attitudes towards the use of computers in education

Schools were asked to respond to nine statements that capture how teachers view and feel about the use of computers in education. Statements were positively and negatively phrased to reduce the possibility of a biased response set. Table 6.6.1 summarises the frequency and percentage distribution of the responses. In a follow-up question, respondents were asked to rank-order the three most common feelings that teachers have towards the introduction of computers in education. The respondents' first choices are presented in Figure 6.6.1.

Both the table and figure show that three attitudes are widely held by respondents. These are:

- Computer skills provide learners with greater job opportunities.
- Computers help learners to think and work independently.
- Computers can be useful in preparing lessons and administrative tasks.

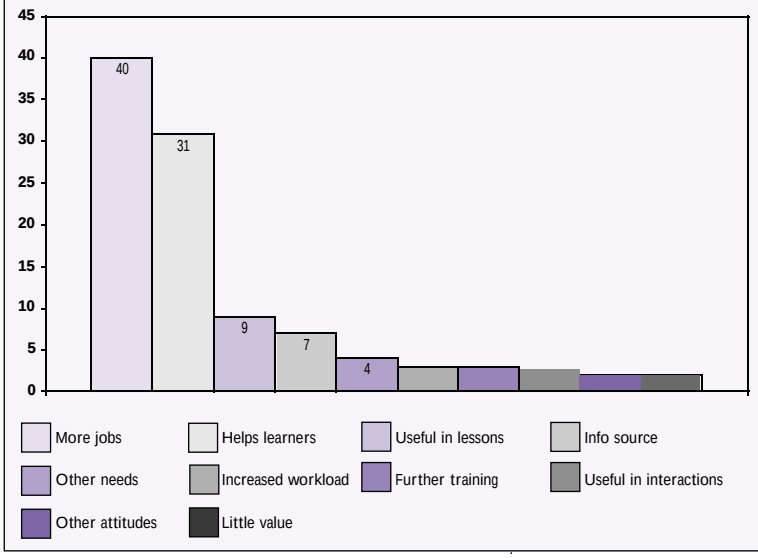
The data also shows that the majority of respondents rejected the statements expressing negative attitudes towards the use of computers. Only one statement – 'Computers can be used to allow learners and teachers to interact with other schools through e-mail or joint projects' – did not find overwhelming support, with 55% disagreeing.

More detailed analysis of these responses with the range of grouping variables used in previous sections – school type, province, geographical location, and total number of computers – did not produce any significant results. While this suggests an overwhelmingly positive response of teachers to the use of ICTs in their school, some interesting variations to this trend will be discussed in Section C of the report.

Table 6.6.1: Attitudes of teachers towards the use of computers in education

		Yes	No
Provide job opportunities			
	Count	756	206
	%	79	21
Little value in using computers in learning			
	Count	45	917
	%	5	95
Other learning should get higher priority			
	Count	110	852
	%	11	89
Computers important in helping learners to work independently			
	Count	697	265
	%	72	28
New technology might increase workload			
	Count	116	846
	%	12	88
Teachers might be required to do further training			
	Count	166	796
	%	17	83
Computers useful in preparation of lessons and administration			
	Count	698	264
	%	73	27
Computers are an important source of information			
	Count	631	331
	%	66	34
Computers are useful for interaction			
	Count	432	530
	%	45	55

Figure 6.6.1: Rank ordering of teachers attitudes towards the use of computers



The rank ordering of responses in Figure 6.6.1 shows that teachers are convinced that computers will provide learners with greater job opportunities (40% hold this view) and also that computers are important because they help learners to think and work independently (31% of respondents chose this option). A further 9% indicated that computers can be used in lesson preparation and administration.

Start-up date and reasons for beginning to use computers

Schools were asked to indicate when they first began to use computers actively. The six response categories were recoded into three: those starting before 1990, those starting between 1990 and 1994 and those only starting after 1994. The results are summarised in Table 6.6.2.

The period 1990 to 1994 is when most of the schools that have computers first began to use them actively. The table shows that among the primary schools in the sample, 26% started to use computers prior to 1990. 39% started between 1990 and 1994, and 36% started from 1995 onwards. Similarly, among the secondary schools, 34% started up prior to 1990, 43% started between 1990 and 1994, and only 24% of these schools started after 1995.

This pattern applies to all provinces except the Free State and KwaZulu-Natal, where larger proportions of schools started to use computers prior to 1990. Slightly more than 40% of schools in the Free State indicated that they started using computers prior to 1990, 22% started between 1990 and 1994 and 37% started from 1995 onwards. In KwaZulu-Natal, 36% of the schools indicated that they began to use computers prior to 1990, with 33% indicating that this had happened between 1990 and 1994, and 31% identifying the post 1995 period as the time that they first started to actively use computers in their schools.

It is interesting to note the trends that are evident in urban schools compared to those in the peri-urban and rural areas. In urban areas, 40% of schools indicated that they started using computers between 1990 and 1994, compared to 31% and 29%, before 1990 and after 1994 respectively. However, in the peri-urban areas 42% of schools started using computers after 1994, 29% started before 1990 and another 29% started between 1990 and 1994. Among the rural schools that responded, 47% indicated that they started using computers after 1994, 15% started before 1990 and 38% started between 1990 and 1994.

Although the total number of schools that responded from the urban areas was much higher than from the peri-urban and rural areas, it is important to note that outside the urban areas most of the schools which have computers have only had them since 1995.

While the overall trend indicates the 1990 to 1994 as the time in which the greatest percentage of schools in the sample started to use computers, some interesting patterns are evident when the number of computers that schools have are considered in relation to their start-up date.

- Of those schools that have 10 computers or less only 22% started before 1990, 40% started in the period 1990 – 1994 and 38% started after 1994.
- Of the schools that had 11 – 29 computers, 29% started before 1990, 38% started between 1990 and 1994, and 34% started after 1994.
- Where the schools have 30 computers or more it is interesting to note that 39% indicated that they started to use computers before 1990. This increased slightly to 42% of these schools starting between 1990 and 1994. And only 20% of these schools started after 1994.

So among the schools with 30 or more computers, there is a percentage decrease of 22% in the period after 1994. However, among

those schools with only 10 computers or less, the percentage decreased by only 2% after 1994 and by only 4% for those schools with 11 to 29 computers during the same period. More specifically, 81% of the schools with 30 computers or more started using computers prior to 1995; while 62% of the schools with 10 or less started using them prior to 1995.

The evidence suggests that generally, schools which are now comparatively well-equipped have been using computers for a longer period of time than those with less computer resources. These results also suggest that there has been a tendency for schools to increase their computer resources over time. The comparatively small percentage of well-resourced schools that only started using computers after 1994 (20%) suggests that the tendency to immediately start using computers with a minimum level of thirty machines is relatively rare.

Schools were also asked to indicate what the main reasons were that led them to start using computers when they did. The evidence showed that from the reasons related to:

- preparing students for the future
- improving student learning
- facilitating new forms of learning
- keeping the curriculum up-to-date
- to offer community access to computers
- streamlining school administration.

Priorities for computer use in schools

What are the priorities for computer use in schools? The responses to this question are summarised in Table 6.6.3 In a follow-up question, schools were also asked to rank-order their preferences as far as priorities for computer use is concerned. These rank orderings are presented in Figure 6.6.2.

Given the trends that were noticed in the previous table, the data presented in Table 6.6.3 is somewhat surprising. More than 80% of schools said that they would prioritise the use of computers in school management and administration. This is followed by smaller percentages – although still quite high – for computers to be used in the teaching and learning context. Only two 'uses' did not get majority support as a priority: using computers in lesson preparation and staff development (both received 48% support). One possible explanation for this (slight) anomaly is that respondents could have argued that these uses are not mutually exclusive. One can prioritise the use of computers in management and administration and also view them as useful in the classroom.

The trends noted in Table 6.6.3 are repeated in Figure 6.6.2. The graph shows the distribution of items identified by the schools as their most important priority (choice 1). The dominance of computers for school

Table 6.6.2: Profile of schools according to start-up date

School started to use computers actively?	Before 1990		1990 - 1994		1995 and after		Total	
	Count	Row %	Count	Row %	Count	Row %	Count	Col %
Type of school								
Primary	108	26	161	39	149	36	418	48
Secondary	111	34	141	43	79	24	331	38
Combined	40	35	38	33	36	32	114	13
Province								
E/Cape	26	33	30	38	23	29	79	9
Free State	28	41	15	22	25	37	68	8
Gauteng	59	27	103	47	56	26	218	24
KZN	58	36	53	33	50	31	161	18
Mpumalanga	11	22	23	47	15	31	49	5
N/Province	1	8	6	46	6	46	13	1
N/Cape	5	16	14	45	12	39	31	3
Northwest	14	35	16	40	10	25	40	4
W/Cape	64	27	93	39	80	34	237	26
Geographical location								
Urban/towns	235	31	310	40	222	29	767	89
Peri-urban	7	29	7	29	10	42	24	3
Rural	11	15	27	38	34	47	72	8
Computer studies as a school subject								
Yes	135	36	144	39	93	25	372	43
No	122	25	196	40	168	35	486	57
Total number of computers (categories)								
10 & less	56	22	102	40	98	38	256	29
Bet. 11 & 29	99	29	131	38	116	34	346	39
30 & more	107	39	115	42	54	20	276	31
Total	**262**	**30**	**348**	**40**	**268**	**31**	**878**	**100**

Table 6.6.3: Preferred priorities for computer use in schools

		Yes	No
Use computers in school management and administration			
	Count	798	164
	%	83	17
Computers for staff development			
	Count	462	500
	%	48	52
Computer use for lesson preparation			
	Count	460	502
	%	48	52
Computers as teaching and learning tools			
	Count	723	239
	%	75	25
To teach computer skills			
	Count	747	215
	%	78	22
To expose students to benefits of computers in everyday life			
	Count	726	236
	%	75	25

management and administration is once again evident (29%), closely followed by the use of computers as a teaching and learning tool in all subjects (28%) and the teaching of computer skills (25%). Interestingly, the use of computers in staff development and lesson preparation is not regarded as the first priority by most of the schools. The evidence clearly shows that most schools see the use of computers to support learners and school management and administration as more of a priority than providing teachers with 'teaching' support, such as help with lesson preparation and training.

Figure 6.6.2: Rank ordering of most important uses of computers (First choice)

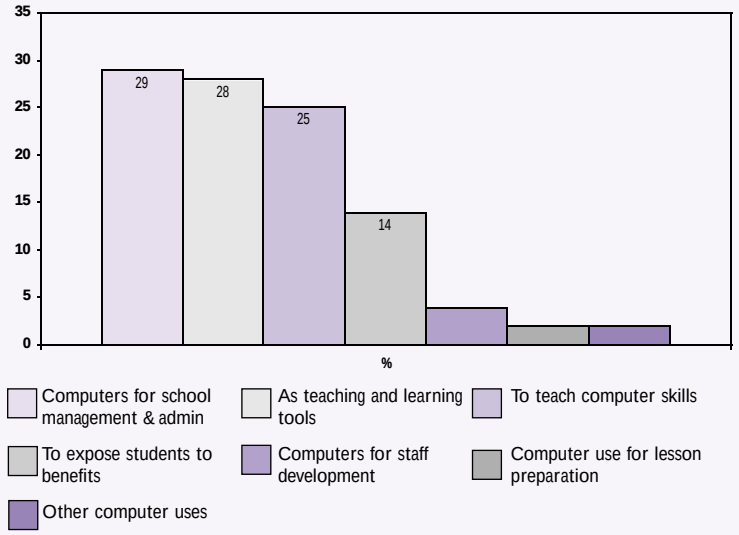


Table 6.6.4: Computer usage

		None	< 50%	>50%
Management (computer usage)				
	Count	63	353	441
	%	7	41	51
Administration (computer usage)				
	Count	16	79	801
	%	2	9	89
Teachers (computer usage)				
	Count	28	559	303
	%	3	63	34
Learners (computer usage)				
	Count	89	369	427
	%	10	42	48

Profiles of computer users at schools

Who are the regular computer users at schools? Respondents were asked to indicate what proportions of different groups are regular computer users. Five responses were possible: None, 1–25%, 26–50%, 51–75% and over 75%. The responses were then recoded into three categories. Table 6.6.4 presents the data. The fact that 89% of schools indicated that more than half of their administrative staff are regular computer users is not unexpected. Interestingly, more than 50% of the schools said that more than half of the managers are regular computer users. Equally interesting is the fact that 48% of schools said that more than half of their learners are regular computer users while 34% of schools indicated that more than half of their teachers are regular computer users.

In the further analysis, it was decided to concentrate on the upper half of the table, i.e. only those schools where more than 50% of the various groups were indicated as being regular computer users. Table 6.6.5 summarises the results for this group for the four categories of users using the grouping variables as before.

The frequent use of computers by administrative staff is evident across all subgroups. This is perhaps not surprising given that administrative and clerical functions are part of all schools and should not be affected by the level of schooling offered, geographical location, etc. Similarly, as far as computer use among management is concerned, no significant differences are found across any of the subgroups.

More substantial differences become evident when we look at the profile of computer use amongst teachers. There are quite large provincial differences: ranging from low proportions in the North West province (16%) and Mpumalanga (21%) to higher percentages in the Northern Cape (47%) and Free State (46%).

Also, there is a clear relationship between

Table 6.6.5: Comparison of regular computer users

	Management		Admin.		Teachers		Learners		Total
	More than 50%		More than 50%		More than 50%		More than 50%		
	Count	Row %	Count	Row %	Count	Row %	Count	Row %	Count
Type of school									
Primary	215	54	369	90	134	33	229	57	405
Secondary	156	49	296	89	121	36	118	36	330
Combined	54	50	105	91	40	35	65	57	115
Province									
E/Cape	38	48	74	93	32	40	37	47	78
Free State	38	57	69	95	32	46	23	32	71
Gauteng	130	61	209	95	73	33	118	54	220
KZN	58	40	130	81	48	30	84	53	159
Mpumalanga	21	48	43	90	10	21	20	42	48
N/ Province	5	36	12	92	5	36	8	57	14
N/ Cape	15	47	26	87	14	47	9	31	29
North West	20	53	32	84	6	16	17	45	38
W/Cape	116	52	206	88	83	36	111	49	228
Geographical location									
Urban/towns	381	52	698	90	260	34	369	48	761
Peri-urban/semi-towns	11	48	16	70	4	17	11	42	26
Rural	38	56	58	84	28	41	31	45	69
School started to use computers actively									
Before 1990	145	60	239	92	109	42	142	54	262
1990 – 1994	172	52	310	91	117	34	151	45	335
1995 and after	109	44	223	87	69	27	118	47	253
Computer studies as a school subject									
Yes	182	51	340	90	137	37	207	55	379
No	239	51	434	89	153	31	208	44	476
Total number of computers (categories)									
10 and less	116	46	207	82	67	27	50	21	243
Between 11 and 29	148	47	307	90	103	30	173	51	338
30 and more	170	62	274	96	130	46	200	70	286
Total	**434**	**52**	**788**	**90**	**300**	**34**	**423**	**49**	**867**

start-up date and computer usage amongst teachers. Those schools that started using computers before 1990 have larger proportions (42%) of regular users compared to those who only started more recently (27% of teachers in schools which started after 1995).

Again, whether or not a school offers Computer Studies is also highly correlated with computer use amongst teachers. Furthermore, the total number of computers in a school also clearly affects computer use by teachers. Well-resourced schools have higher proportions of teachers using computers regularly (46%) when compared to schools with fewer numbers of computers (27%).

The biggest subgroup variation is evident when one looks at the learners. Some provincial differences are recorded: lowest proportions in the Northern Cape (31%), Free State (32%) and highest proportions in the Northern Province (57% – but note that the sample was small), Gauteng (54%) and KwaZulu-Natal (53%). Whether Computer Studies is offered as a school subject makes a difference: 55% of learners in such schools are listed as being regular users compared to 44% of learners in schools which do not offer the subject. Again, the total number of computers in the school is the most significant factor affecting computer usage. In schools where there are more than 30 computers 70% of learners are regular users compared to only 21% of learners in schools with less than 10 computers.

Planned expenditure

It is interesting to note that the item identified by the greatest percentage of schools (76%) is the purchasing of teaching resources such as textbooks for the school. Similarly, 68% of the schools indicated that they would likely be spending money on building alterations during this time. Looking more specifically at computer resources, 64% of the schools indicated that they would use funds to upgrade existing computer facilities and 52% indicated that they would be purchasing new computers. Surprisingly, only 39% of the schools identified teacher training as an envisaged cost over the next two years and only 5% indicated the need to spend more on teacher salaries in the near

Table 6.6.6: Items that the school is likely to spend money on over the next two years

		Yes	No
Purchase of classroom equipment			
	Count	332	630
	%	35	65
Alterations to school building			
	Count	653	309
	%	68	32
Purchase of new teaching resources			
	Count	730	232
	%	76	24
Purchase of new stationery			
	Count	516	446
	%	54	46
Upgrading of existing computer resources			
	Count	612	350
	%	64	36
Purchase of new computers			
	Count	503	459
	%	52	48
Teacher training			
	Count	374	588
	%	39	61
Salary of teachers			
	Count	45	917
	%	5	95

future. While teaching resources appear to be a priority for many schools, only 35% of the sample indicated that they would be purchasing new classroom equipment such as chalk boards and overhead projectors.

Subgroup analyses revealed few differences except when the number of computers per school was taken into consideration. Of the schools with 10 computers or less, 48% indicated that they would be upgrading existing computer resources and 48% indicated that they would be purchasing new computers. Among the schools with 11 to 29 computers, 67% indicated that they would be upgrading their computers in the next two years and 51% would be purchasing new computer resources. Of the schools that have 30 computers or more, 79% said that they would be upgrading existing computer resources and 61% said that they would be purchasing new computers. It is interesting therefore to see that where schools have a comparatively high level of resources, upgrading and purchasing of new facilities are still seen as a priority for the immediate future. Among this latter group it is also interesting to note that the purchasing of teaching resources and alterations to school buildings are still regarded as short-term priorities for funding by a significant percentage of schools (72%).

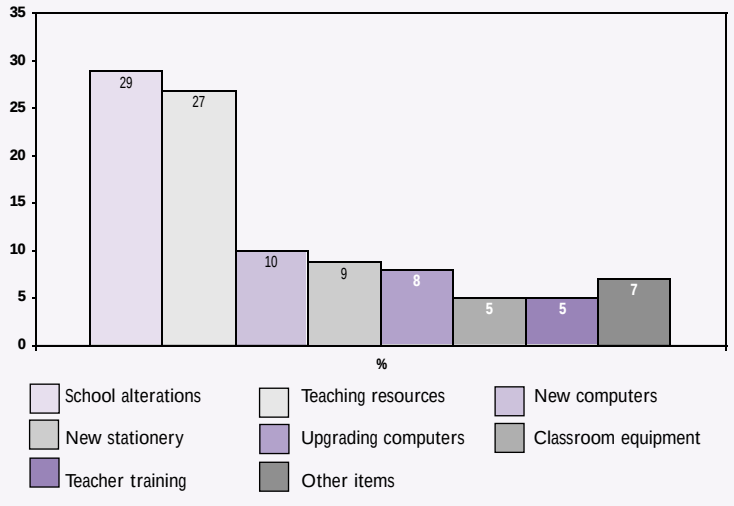
There is also a clear relationship between number of computers per school and the priority given to expenditure on teacher training. Schools with fewer computers tend to be less likely to list teacher training as a priority (35% of the schools with 10 computers or less) compared to those schools with the highest numbers of computers (48%).

While it is important to recognise that what schools have identified as the items which they are likely to spend money on may reflect particular needs which must be met before other choices for expenditure can be made, it is worth noting that despite the level of computer resources which the schools have, less than 50% of the schools in the three computer ownership categories feel that teacher training will likely form part of their budget items over the next two years.

In a follow-up question, schools were asked to rank order the most important items that they will spend money on over the next two years (Figure 6.6.3).

In general, therefore, the priorities identified by most schools relate to basic resources needed for teaching and learning to take place, i.e. adequate classrooms and facilities in the school as well as necessary resources for effective teaching. Although these two items dominate, it is also important to note that 18% of schools identified either the purchase of new computers or the upgrading of existing computers as a priority. The low percentage of

Figure 6.6.3: Rank ordering of expenditure items over next two years



schools which prioritised teacher training (5%) may reflect an attitude on the part of schools that such training is primarily the responsibility of the education departments. It may also be that they do not have sufficient resources at this stage to consider investing school funding into this area or, of course, that schools feel that their teachers are adequately and appropriately equipped and skilled to provide the teaching that is required.

Professional development of teachers

In this section we focus on the provision of technology-related development for teachers (Table 6.6.7), as well as the computer-related training needs that schools have found the most useful.

Table 6.6.7 shows that only 16% of schools indicated that no teachers at the school have had access to any form of technology related professional development. The three main providers of training appear to be the universities or technikons, private organisations such as private colleges and government education departments. Looking comparatively at the responses that were given, 44% of schools have accessed education department run training opportunities, 26% indicated that they had had access to courses run by universities or technikons and 30% had been on courses offered by private institutions. If the three kinds of training opportunities are considered in relation to the grouping variables used in earlier tables, some interesting trends can be seen.

Among the primary schools in the sample, 46% indicated that they had had access to training through the education departments. In comparison only 18% of these schools had received training through universities or technikons. However, among the secondary schools, 43% indicated that their teachers had received training through the education departments, 35% indicated that they had received training through the universities or technikons. While this may suggest a slight tendency towards a greater percentage of training at primary schools by the education departments, it seems clear that secondary school teachers largely access training at universities and technikons.

Among the provinces, approximately a third of the respondents indicated having had access to each of the three training providers. That is, in most of the provinces approximately the same percentage of schools indicated access to university/technikon training, as those of who had accessed courses from private organisations and the education department.

However, there are some exceptions to this that are interesting to consider. In the Eastern Cape, 65% of the respondents indicated having had access to government department training, while 35% indicated access to university/ technikon training or private organisation courses. In the Western Cape, 67% of the respondents had received training through the education department. In comparison only 16% had received training through a university or technikon and 22% through private institutions. It is strongly hypothesised that these differences are largely due to the extent of provision of training by the education departments in these provinces. While the Northern Cape respondents indicated that 56% had had access to training through the education department, in all of the other six provinces, less than 38% of the respondents

Table 6.6.7: Technology-related professional development options

		Yes	No
No teacher has access to computer development			
	Count	155	807
	%	16	84
Courses on basic introduction			
	Count	544	418
	%	57	43
Courses offered by university/technikon			
	Count	248	714
	%	26	74
Courses offered by private institutions			
	Count	287	675
	%	30	70
On-site visits to other schools			
	Count	231	731
	%	24	76
On-line distance learning			
	Count	34	928
	%	4	96
Professional mentoring			
	Count	110	852
	%	11	89
Collaborative training opportunities			
	Count	186	776
	%	19	81
Courses offered by education department			
	Count	420	542
	%	44	56

Table 6.6.8: Courses offered by different types of institutions

	Univ./Tech		Private institutions		Educ. dept		Total
	Yes	No	Yes	No	Yes	No	
	Row %	Row %	Row %	Row %	Row %	Row %	Count
Type of school							
Primary	18	82	25	75	46	54	446
Secondary	35	65	36	64	43	57	350
Combined	27	73	28	72	39	61	127
Province							
E/Cape	35	65	35	65	65	35	82
Free State	31	69	35	65	32	68	77
Gauteng	30	70	33	67	37	63	235
KZN	28	72	34	66	26	74	168
Mpumalanga	10	90	24	76	26	74	50
N/Province	26	74	32	68	21	79	19
N/Cape	25	75	19	81	56	44	36
North West	38	62	40	60	18	82	45
W/Cape	16	84	22	78	67	33	250
Geographical location							
Urban/towns	27	73	31	69	44	56	808
Peri-urban/semi-towns	18	82	32	68	18	82	28
Rural	20	80	22	78	45	55	87
School started to use computers actively							
Before 1990	31	69	40	60	47	53	266
1990 – 1994	26	74	28	72	47	53	353
1995 and after	21	79	25	75	39	61	277
Computer studies as a school subject							
Yes	35	65	33	67	39	61	388
No	21	79	28	72	48	52	522
Total number of computers (categories)							
10 and less	20	80	24	76	42	58	280
Between 11 and 29	27	73	31	69	48	52	353
30 and more	31	69	36	64	42	58	288
Total	**26**	**74**	**31**	**69**	**44**	**56**	**921**

had received training through the departments of education.

According to the data, the schools that have had the most access to government training opportunities are those that acquired computers before 1990. However, while 47% of the schools that started using computers prior to 1995 indicated that they had had access to training provided by the government departments, only 39% of those who started after this time had had access to this type of training. It is also interesting to note that among those schools that started using computers prior to 1990, 40% indicated that they had had access to training through private institutions. In contrast, only 28% of schools starting between 1990 and 1994 had accessed opportunities of this nature and only 25% of the schools that started after 1995 had done so.

Of further interest with respect to the different types of computer training is what respondents identified as the most useful (Figure 6.6.4). Here the courses provided by the various educational departments together with courses on basic introduction to computers received by far the most support (26% and 25%). Courses provided by the higher education institutions and private institutions were next in line with support from 11% of the schools. The responses regarding the most useful type of training overlap strongly with the types of training most respondents identified as those which teachers at their school had had access to. It is particularly important to note the positive response given to the training given by the provincial departments. It appears to have been well targeted and relevant to teacher's needs. However, it should also be remembered that the responses reflected in Figure 6.6.4 refer to the usefulness of courses and therefore to issues of quality. However, if one takes into consideration the fact that less than half of the schools from the sample had had access to courses offered by the education departments, the extent of training remains quite limited.The important implications of this are addressed in more depth in Section C.

Table 6.6.9 provides an overview of what the respondents felt were the most important training needs for teachers. The greatest percentage of respondents (84%) wanted training on how to incorporate computers into

the learning process. Training about the basics of computers and their applications also received a lot of support. Of less importance, were areas such as the use of computers for administration and information acquisition. From these responses, it seems clear that training which is orientated towards building capacity and competence to use computers in the teaching and learning process and thus to improve teacher's confidence in this area is regarded as very important by the respondent schools.

Conditions underlying the use of computers in the school

We asked schools to list the factors that prevent the school from maximising the use of computers. Table 6.6.10 summarises the responses for the question as a whole.

The item which the greatest percentage of schools identified as limiting the use of computers was the lack of staff trained to use computer equipment and software. More than half the schools indicated that this remained a hindering factor for them. Despite this, many schools do not regard teacher training as a priority item for school expenditure in the next two years (as shown earlier in Figure 6.6.3).

Another factor identified by over a third of the sample was the lack of classrooms suitable for computers. This concern can be linked to the identification of alterations to the school building as the most important funding priority for 29% of the schools over the next two years (see Figure 6.6.3).

The rank ordering of factors hindering the continued use of computer facilities at schools is presented in Figure 6.6.5.

Factors limiting access to the Internet

Schools were asked to specifically consider the area of Internet use and to identify the factors that prevented them from making more effective use of this facility.

By far the most frequently

Figure 6.6.4: The most useful professional development training (First choice)

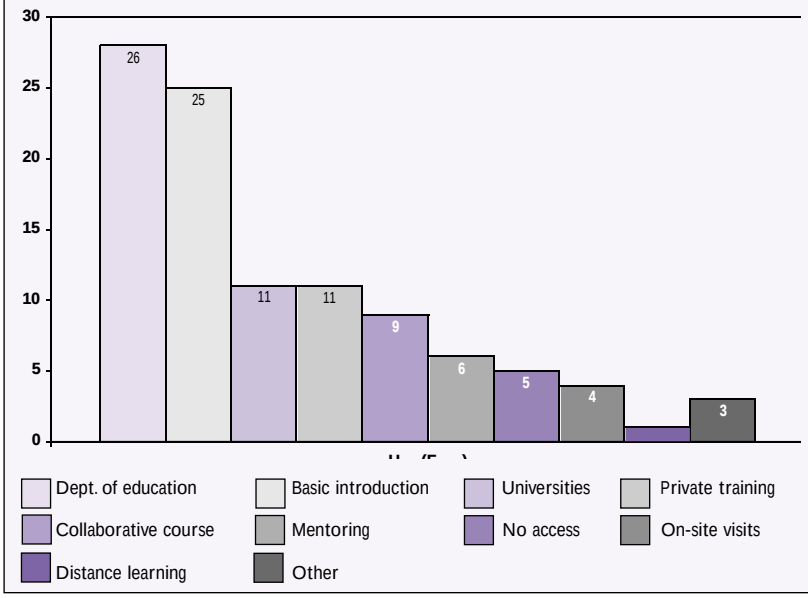


Table 6.6.9: Computer-related training needs

		Yes	No
Basic introduction to computers			
	Count	675	287
	%	70	30
Introduction to applications			
	Count	797	165
	%	83	17
How to incorporate computers into learning process			
	Count	812	150
	%	84	16
Computers for administrative functions			
	Count	693	269
	%	72	28
Computers for information acquisitions			
	Count	693	269
	%	72	28
Using computers for communication			
	Count	327	635
	%	34	66

Table 6.6.10: Conditions preventing maximum use of computers

		Yes	No
Limited classrooms			
	Count	372	590
	%	39	61
Poor ventilation and lighting			
	Count	59	903
	%	6	94
No electricity			
	Count	7	955
	%	1	99
Inadequate electricity supply			
	Count	34	928
	%	4	96
No phone line			
	Count	39	923
	%	4	96
Vandalism of equipment			
	Count	107	855
	%	11	89
Poor security at school			
	Count	108	854
	%	11	89
Obsolete computer equipment			
	Count	317	645
	%	33	67
Lack of available staff			
	Count	523	439
	%	54	46
Financial constraints			
	Count	110	852
	%	11	89

Figure 6.6.5: Factors hindering the maximum use of computers

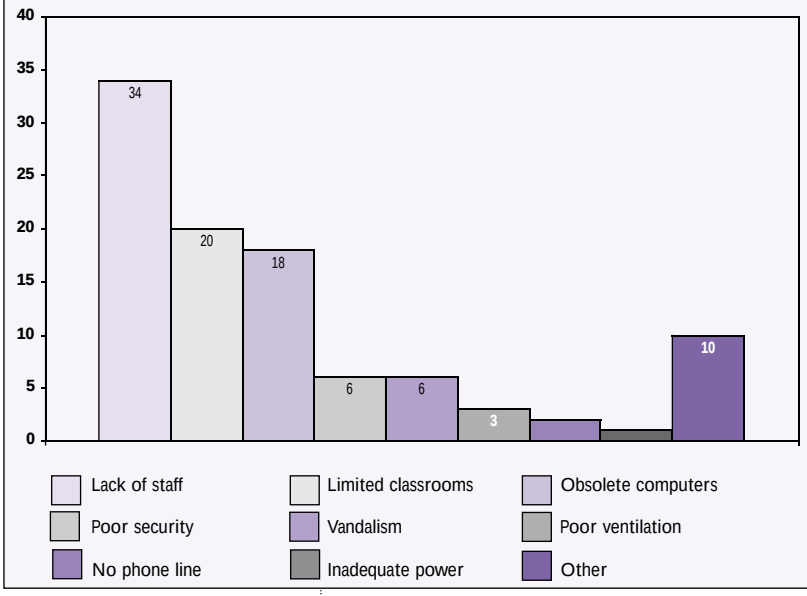
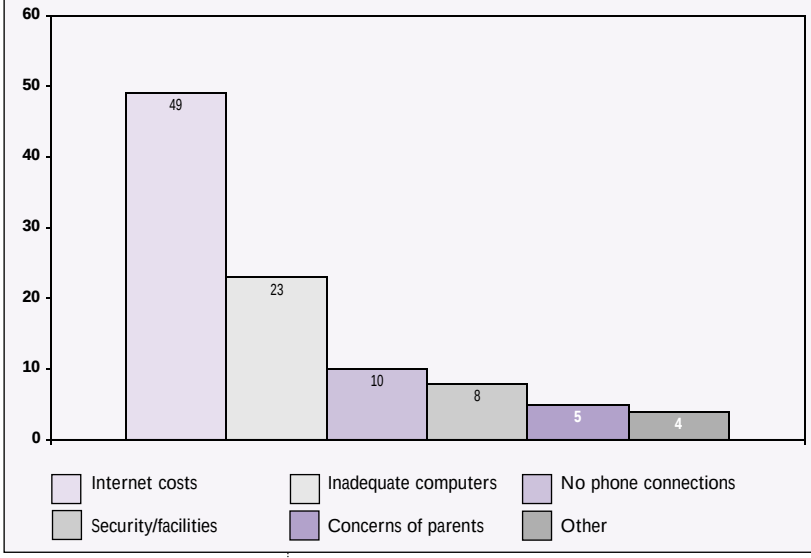


Figure 6.6.6: Rank ordering of factors limiting Internet access at the school (First priority)



identified factor is the cost of Internet access – 49% of the respondents identified the cost factor. Another 23% noted that their computers do not have the capacity and facilities for Internet access. 10% of the respondents identified the problem of no phone line connections in classrooms. Other items such as security and concern by parents and teachers regarding abuse of the Internet were indicated by only 13% of the respondents.

When schools were asked to identify the factor that most limits their use of the Internet (Figure 6.6.6) the overwhelming majority of respondents indicated that the costs involved in accessing the Internet presented the greatest barrier to using the Internet more effectively. Thus the evidence suggests that whatever the level of resources among schools the relatively high costs involved in making use of the Internet limits its effective use among the school sector.

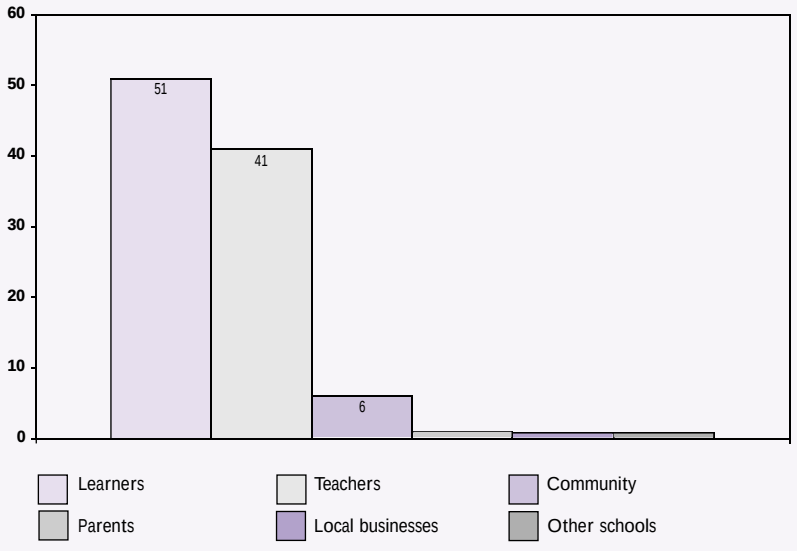
Summary

- The attitudes of teachers towards the use of computers in education are generally positive with few concerns being expressed regarding possible negative effects such as extra workload for teachers or that computers have little value in teaching and learning.
- The evidence shows that in general the greatest number of the schools in the sample started to use computers between 1990 and 1994, with slight variations to the trend being seen across the different provinces. The most interesting variation to this trend is evidenced when the respondents were grouped according to their location as urban, peri-urban or rural. Among the latter group of schools, most started to use computers after 1995.
- In general, the evidence shows that schools that are now comparatively well-resourced have been using computers for a longer period of time. Among the schools that have 30 or more computers, 81% indicated that they started before 1995. Whereas among the schools with 10 computers or less, only 62% started prior to 1995.
- The evidence suggests that schools started to use computers with potential benefits to learners very much in mind. However, most respondents appear to now also regard school administration and management as a priority for the use of computers.
- A comparison of priorities for computer use also show a distinct tendency towards management, administration and learner support above the support which computers can offer teachers in terms of lesson preparation and access to further training.
- In identifying the items that they are likely to spend money on in the next two years, 29% of schools indicated that alterations to the school premises would be the most important priority for them over the next two years. This was closely followed by 27% of the respondents indicating the purchase of new teaching resources such as textbooks. 10% of the schools prioritised new computers and 8% indicated that they would prioritise the upgrading of existing computer resources. The purchase of computer resources (new purchases or uprgrading) appears to become increasingly important as the number of computers in the school increases.
- Although there is a strong indication that schools feel the need to prioritise the acquisition of basic resources necessary for effective teaching and learning (adequate classrooms, teaching resources, etc.) of particular interest is the fact that only 5% of schools indicated that a priority for their budget over the next two years would be teacher training. While this may reflect a feeling on the part of schools that this remains a Department of Education responsibility and/or they do not have sufficient funds to invest in this area, it is interesting to note that in identifying conditions hindering effective computer use, the greatest percentage of schools (54%) indicated that the lack of available staff trained to use computers was the biggest problem.
- Despite the stated need for more staff with computer skills, at least 84% of the respondents indicated that some teachers at their school have had access to technology-related professional training opportunities of some kind. Although this indicates a relatively high level of access to training it is important to note that this does not necessarily mean that all teachers at the school have had access to such training, but rather that some of the teachers at the school have had access to training.
- In listing who has provided training opportunities for teachers, the responses from the schools show that the greatest percentage of respondents have had access to courses run by the Department of Education (44%). In comparison, 26% have had access to courses run by universities or technikons and 30% to those offered by private institutions.
- While approximately a third of the respondents in most of the provinces indicated that they had had access to Department of Education training initiatives, the Eastern Cape (65%) and Western Cape (67%) stand out strongly as the provinces where a greater number of schools have had access to these initiatives.
- Although, as has been stated, the lack of adequately trained staff was identified by the greatest percentage of schools as hindering computer use (and noted by 34% of the schools as the most important hindering factor), limited classrooms suitable for computer use and obsolete equipment also feature strongly as hindering factors for many schools (39% and 33% respectively).
- Looking specifically at Internet access, the greatest percentage of respondents identified the costs associated with Internet use as the most important factor limiting its effective use.

Table 6.7.1: Use of school computers after school hours by students

Are school computers used after hours?	Yes		No		Total
	Count	Row %	Count	Row %	Count
Type of school					
Primary	232	56	183	44	415
Secondary	218	65	118	35	336
Combined	63	53	56	47	119
Province					
E/Cape	53	69	24	31	77
Free State	41	60	27	40	68
Gauteng	141	62	85	38	226
KZN	84	51	80	49	164
Mpumalanga	23	50	23	50	46
N/Province	8	57	6	43	14
N/Cape	15	44	19	56	34
North West	20	51	19	49	39
W/Cape	141	59	97	41	238
Geographical location					
Urban/towns	462	60	304	40	766
Peri-urban/semi-towns	13	52	12	48	25
Rural	33	42	46	58	79
School started to use computers actively					
Before 1990	171	68	82	32	253
1990 – 1994	196	58	144	42	340
1995 and after	146	54	123	46	269
Computer studies as a school subject					
Yes	283	74	98	26	381
No	229	47	262	53	491
Total number of computers (categories)					
10 and less	78	31	176	69	254
Between 11 and 29	211	61	137	39	348
30 and more	232	84	45	16	277
Total	**521**	**59**	**358**	**41**	**879**

Figure 6.7.1: Groups that make most use of school computers after hours



Optimising computer resources: after hours use

In this section, the use of computers after school hours by learners, teachers and other groups is discussed. An attempt is made to explore ways that schools are able to generate additional income through the use of school computers beyond the normal teaching day.

Learners at approximately 59% of schools that have computers make use of this equipment after school hours. Analysing this information in terms of the grouping variables used throughout this study, it can be seen that:

- Slightly more secondary schools (65%) than primary schools (56%) have students who make use of their computers after school hours.
- Schools in the Eastern Cape show a greater inclination to use computers after school hours.
- Schools that started using computers before 1990 appear to make more extensive use of computers after school hours
- Almost three-quarters (74%) of schools that offer Computer Studies as a school subject have learners who use the school computers after school hours, compared to 47% of learners where Computer Studies is not a curriculum subject.
- There is a strong association between the number of computers at a school and the degree to which learners use these computers after hours. 31% of schools that have 10 or less computers have learners that use the machines after hours. This increases to 61% of schools that have between 11 and 29 computers and to 84% for schools that have 30 or more computers.

Only at 10%–4% of schools do the majority of learners across all grades make use of the school's computers after school hours. A minority of learners across all grades at the remaining schools make use of school computers after school hours. With regards to gender, it appears that at the primary level, slightly more girls are using the computers, while at secondary level more boys use the computers after hours; this is particularly true in Grades 11 and 12. Further investigation shows that there are infrastructure (e.g. computer laboratories) and organisational preconditions (teacher supervision after school hours, safe environment, etc.) that facilitate the extended use of school computers by learners after school hours.

Even though the numbers are small, Figure 6.7.1 shows that the groups that make the most use of school computers after hours tend to be learners and teachers. Learners make use of school computers after hours at 51% of schools, and teachers do so at 41% of schools.

Extending the inquiry into the use of school computers by groups after school hours in relation to the number of computers that a school possesses, a number of interesting observations emerge. After school use of computers by learners increases in tandem with an increase in the number of computers a school possesses. In schools with 10 or less computers, 23% of learners make use of school computers after school hours. In schools with between 11 and 29 computers this ratio increases to 49% of learners. It increases further to 72% in schools that have 30 or more computers.

An inversion of this is evident for the use of computers after hours for teachers. At schools that have 10 or less computers, a higher proportion of teachers make use of the computers after hours compared to schools that have between 11 and 29 computers and schools that have 30 and more computers. This suggests that in schools with fewer computers, these are used more as managerial and administrative tools after school hours than schools that have more than 10 computers where the opposite occurs.

Table 6.7.3: Number of computers and use of computers after school

Total number of computers (categories)		Yes	No	Total
10 and less				
After hours use – Students	Count	64	216	280
	%	23	77	100
After hours use – Teachers	Count	127	153	280
	%	45	55	100
After hours use – Community members	Count	1	279	280
	%	0	100	100
Between 11 and 29				
After hours use – Students	Count	172	181	353
	%	49	51	100
After hours use – Teachers	Count	117	236	353
	%	33	67	100
After hours use – Community members	Count	19	334	353
	%	5	95	100
30 and more				
After hours use – Students	Count	208	80	288
	%	72	28	100
After hours use – Teachers	Count	64	224	288
	%	22	78	100
After hours use – Community members	Count	19	269	288
	%	7	93	100

Only a small percentage of schools offer their facilities for use by outside groups. However, schools with 30 or more have a higher proportion of outside groups making use of their computers (7%).

About two-thirds of schools (63%) which allow for outside groups to use its computers, charge a fee. This data highlights two interesting features.

- Schools in the Eastern Cape and North West provinces tend more often to charge fees. This may represent a potential opportunity for a partnership with outside groups in a way that enhances and develops resources.

Table 6.7.5: Does the school charge a fee for the use of its computers by outside groups?

	Yes		No		Total
	Count	Row %	Count	Row %	Count
Type of school					
Primary	91	64	52	36	143
Secondary	82	63	49	37	131
Combined	26	49	27	51	53
Province					
E/Cape	17	77	5	23	22
Free State	17	55	14	45	31
Gauteng	48	62	30	38	78
KZN	25	42	34	58	59
Mpumalanga	10	63	6	38	16
N/Province	2	40	3	60	5
N/Cape	11	65	6	35	17
North West	14	88	2	13	16
W/Cape	63	67	31	33	94
Geographical location					
Urban/towns	171	61	108	39	279
Peri-urban/semi-towns	8	73	3	27	11
Rural	20	56	16	44	36
School started to use computers actively					
Before 1990	69	62	43	38	112
1990 – 1994	70	63	41	37	111
1995 and after	59	59	41	41	100
Computer studies as a school subject					
Yes	116	67	57	33	173
No	86	55	69	45	155
Total number of computers (categories)					
10 and less	15	26	42	74	57
Between 11 and 29	86	67	43	33	129
30 and more	104	75	34	25	138
Total	**205**	**63**	**119**	**37**	**324**

- The likelihood of schools to charge fees for computer use by outside groups increases according to the number of computers that a school possesses. Schools with 30 and more computers are more likely to charge a fee to outside groups for the use of computers, compared to schools which have between 11 and 29 computers and schools which have 10 and less computers.

Summary

- At two thirds of schools, learners make use of school computers after school hours. This is being done to a marginally greater extent at secondary schools. Learners at schools that started using computers before 1990 appear to make more extensive use of computers after school hours than learners based at schools that introduced computers at a later date. Schools where Computer Studies is taught also tend to have a significantly higher proportion of learners who use school computers after school. However, it is interesting to observe a dramatically opposite trend in the use of school computers by teachers after school hours. At schools that do not offer Computer Studies as a school subject, a higher proportion of teachers use computers after hours.
- At a very basic empirical level, a relatively positive association is shown to exist between the number of computers a school possesses and the propensity of learners at the school to make use of these computers after school hours.
- It is important to note that at about 90% of the schools where learners make use of school computers after school hours there are only a minority of learners who actually use the computers. At only 10% to 14% of schools do the majority of learners across all grades use computers after hours. Usage of school computers by learners after hours is accompanied by after hours use by teachers as well.
- The use of school computers after school hours by learners increases, as the number of computers that a school possesses increases. However, after hours use of computers by teachers is higher at schools with 10 or less computers.
- Outside groups make use of schools' computers at only a small proportion and this mainly happens at schools that have 30 or more computers. Two-thirds of schools (63%) charge a fee for outside groups.

7

Schools without computers

This chapter provides a detailed overview of the findings from the questionnaires received from schools that have no computers. Like the previous chapter it provides an overview of all the questions asked in the questionnaire and presents the data in tables followed by a description of the most pertinent findings. The chapter presents the analysis of the data using specific grouping variables against which the data is compared. The grouping variables used are type of school, province and ratio of educators to learners where relevant.[1] The findings from this part of the survey are integrated into the analysis presented in Section C.

Profile

Given the importance of power supply, telephone lines and adequate space for computers, the first set of questions in Questionnaire B aimed to establish whether schools had acquired these three resources after 1996 – i.e. since the HSRC's School Register of Needs Survey had been done.

Nearly half of the schools have acquired either electricity (48.8%) or telephone lines (44.4%) and nearly one quarter (22.6%) have acquired additional classrooms over the past three years. There are no great differences across types of schools, but significant variation does occur across provinces. The Eastern Cape and Northern Province have not fared as well as other provinces as far as provision of electricity and telephone lines are concerned. This is a trend that reconfirms the status of these two provinces as being the least well-resourced in the country. There seems to be more variation regarding additional classrooms but the small number of returned questionnaires, makes a comparison rather risky.

Schools were also asked to complete a checklist of technological resources that included computers, television sets, overhead projector,s etc. The data in Table 7.1 shows that the majority of schools do not have the technologies listed. In a follow-up question, schools were asked to indicate what their priorities are in terms of items of expenditure over the next two years. The results are summarised in Table 7.2.

It is evident from Table 7.2 that basic infrastructure (school buildings) and equipment (classroom equipment, stationery) are regarded as more urgent than, for example, teacher training. This could, of course, either be because teacher training has received some attention in the past or that it is regarded, as has been the case in the past, as primarily the responsibility of the Department of Education and not schools themselves. The rank-ordering of priorities is summarised in Figure 7.1.

Attitudes towards the acquisition and use of computers

A number of questions were included in the questionnaire to assess the attitudes of teachers towards the acquisition of computer facilities, their intended use and the conditions that are required before computers could ideally be acquired. Respondents were first

1. Educator to learner ratios have been divided into two categories against which the data is compared. These are schools with, or less than an educator:learner ratio of 1:33, and those with an educator:learner ratio greater than 1:33.

2. Although Questionnaire B was intended for schools without computers, 21 schools indicated that they did in fact have computers. This is discussed in more detail in Chapter 2. However, given that they still chose to fill in the questionnaire for no computers, it is assumed that the computers that they do have are used purely for administration and/or management purposes.

asked to indicate – from a list of items – which factors prevent schools from acquiring computer facilities (Table 7.3). In a follow-up question, the most important factors had to be rank-ordered (Figure 7.2).

Although we saw in the previous section that nearly half of the schools in the sample had acquired electricity over the past three years, slightly more than half did not. This is identified as the most important factor preventing computer use in 28% of schools; followed by lack of funding (22%), inadequate classrooms (14%) and lack of available staff trained in computer use (13%). It is interesting to note that as is evident in Table 7.3, when schools identified the range of inhibiting factors, 44% noted inadequate staff as preventing them from acquiring computers (although only 13% identified this as the most important factor).

In order to establish general perceptions and attitudes about the use of computers in education, schools had to indicate which of the attitudes listed in Table 7.4 best describe the views of the teachers in the schools.

Table 7.2: Items schools are likely to spend money on over the next two years

Type of school (recoded)		No	Yes	Total
Primary				
Purchase of classroom equipment	Count	143	138	281
	%	51	49	100
Alterations to school building	Count	216	65	281
	%	77	23	100
Purchase of non-computer resources	Count	130	151	281
	%	46	54	100
Purchase of new stationery	Count	101	180	281
	%	36	64	100
Teacher training	Count	100	181	281
	%	36	64	100
Secondary				
Purchase of classroom equipment	Count	54	47	101
	%	53	47	100
Alterations to school building	Count	80	21	101
	%	79	21	100
Purchase of non-computer resources	Count	51	50	101
	%	50	50	100
Purchase of new stationery	Count	45	56	101
	%	45	55	100
Teacher training	Count	18	83	101
	%	18	82	100
Combined				
Purchase of classroom equipment	Count	22	26	48
	%	46	54	100
Alterations to school building	Count	39	9	48
	%	81	19	100
Purchase of non-computer resources	Count	22	26	48
	%	46	54	100
Purchase of new stationery	Count	17	31	48
	%	35	65	100
Teacher training	Count	18	30	48
	%	38	63	100

Table 7.1: Technology resources by type of school[2]

Type of school (recoded)		No	Yes	Total
Primary				
TVs	Count	230	51	281
	%	82	18	100
Computers	Count	272	9	281
	%	97	3	100
VCRs	Count	238	43	281
	%	85	15	100
Radios	Count	258	23	281
	%	92	8	100
Wind-up radios	Count	274	7	281
	%	98	2	100
OHPs	Count	208	73	281
	%	74	26	100
Slide & tape recorders	Count	269	12	281
	%	96	4	100
Tape recorders	Count	236	45	281
	%	84	16	100
Secondary				
TVs	Count	70	31	101
	%	69	31	100
Computers	Count	94	7	101
	%	93	7	100
VCRs	Count	76	25	101
	%	75	25	100
Radios	Count	86	15	101
	%	85	15	100
Wind-up radios	Count	99	2	101
	%	98	2	100
OHPs	Count	74	27	101
	%	73	27	100
Slide & tape recorders	Count	92	9	101
	%	91	9	100
Tape recorders	Count	85	16	101
	%	84	16	100
Combined				
TVs	Count	29	19	48
	%	60	40	100
Computers	Count	43	5	48
	%	90	10	100
VCRs	Count	32	16	48
	%	67	33	100
Radios	Count	39	9	48
	%	81	19	100
Wind-up radios	Count	47	1	48
	%	98	2	100
OHPs	Count	26	22	48
	%	54	46	100
Slide & tape recorders	Count	44	4	48
	%	92	8	100
Tape recorders	Count	38	10	48
	%	79	21	100

Table 7.3: Factors that prevent schools from acquiring computer facilities

		No	Yes	Total
Limited classrooms	Count	233	220	453
	%	51	49	100
Poor ventilation and lighting	Count	65	388	453
	%	14	86	100
No electricity	Count	190	263	453
	%	42	58	100
Inadequate power supply	Count	38	415	453
	%	8	92	100
No phone line	Count	154	299	453
	%	34	66	100
Vandalism of equipment and facilities	Count	119	334	453
	%	26	74	100
Poor security at school	Count	204	249	453
	%	45	55	100
Obsolete computer equipment	Count	42	411	453
	%	9	91	100
Lack of available staff	Count	253	200	453
	%	56	44	100
Lack of funds	Count	113	340	453
	%	25	75	100

Table 7.4: How teachers feel about the use of computers

		Yes	No	Total
Computers important in helping learners to work independently?				
	Count	391	62	453
	%	86	14	100
Little value in using computers?				
	Count	7	446	453
	%	2	98	100
Computers as important source of information?				
	Count	351	102	453
	%	77	23	100
Other needs should receive greater priority?				
	Count	44	409	453
	%	10	90	100
Computers useful in lesson preparation?				
	Count	325	128	453
	%	72	28	100
Computer skills provide learners with greater job opportunities?				
	Count	359	94	453
	%	79	21	100
Computers will require further training?				
	Count	30	423	453
	%	7	93	100
Computers used for interaction?				
	Count	288	165	453
	%	64	36	100
New technology will increase workload?				
	Count	83	370	453
	%	18	82	100

A follow-up question (Figure 7.3) asked for a rank ordering of the most common feelings listed.

The results in Table 7.4 suggest that most of the positive statements received high levels of support. In descending order, these are:

- Teachers strongly support the use of computers in education as they see computers as important in helping learners to think and work independently (86% agree).
- Teachers feel computer skills will provide learners with greater job opportunities (79% agree).
- Teachers see computers as an important source of information to access resources not available to them in schools (77% agree).

Conversely, teachers are not concerned that the introduction of technology will require them to do further training (only 7% agreed) or would increase their workload (only 18% agreed). When pressed to indicate which of these perceptions are most widely held in the school (Figure 7.3), the view that computers are important tools in helping learners to think and work independently, received the highest proportion of support.

What are the main factors that would motivate schools to start using computers? Schools were asked to select reasons from a list and then indicate which of these reasons they would rate as the most important (Figure 7.4). The results show that the single most important reason is that such a step would help prepare students for the future (60%).

In related questions, schools had to indicate whether they would prioritise certain grades if they were to introduce computers in schools (Table 7.5) and for what purposes computers would be used (Figure 7.5).

Table 7.5 shows that, among primary schools, there appears to be greater support for the use of computers from Grades 4–7 (74%). Among the secondary schools, Grades 8–10 receive the most support as the focus of computer use (70%).

The evidence shows that the majority of respondent schools would use computers for a number of difference purposes. The purpose that is given the most support relates to exposing learners to the benefits of computers

Figure 7.1: Items that schools are likely to spend money on in the next two years

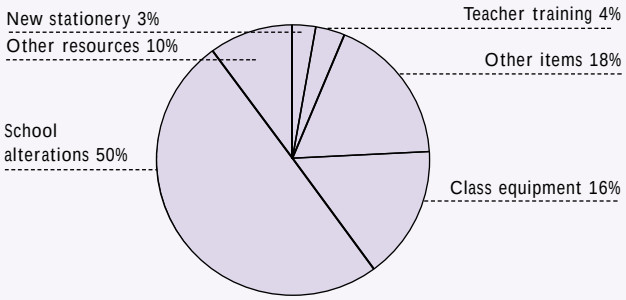
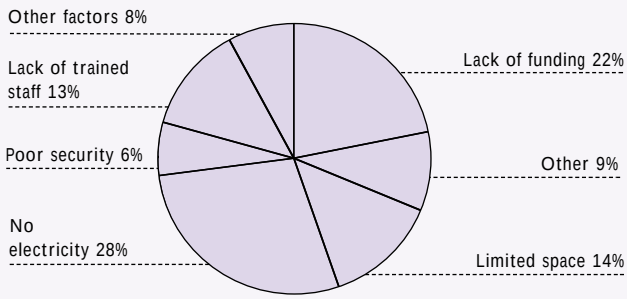


Figure 7.2: Factors that prevent schools from acquiring computer facilities (First choice)[3]



in everyday life. This indicates a clear perception on the part of the respondents towards the potential benefits of computers for learners in and outside the formal learning environment. Significant support is also given to using computers as a teaching and learning tool in all subjects, including the teaching of computer skills as well as the use of computers in school administration. The item that received the least support from schools is the use of computers for educator development. When schools were requested to rank the most important purposes of computer use (see Figure 7.5), school administration received the most support (36%) followed by the use of computers as a teaching and learning tool.

Figure 7.3: Feelings that teachers have about the use of computers in education (First choice)

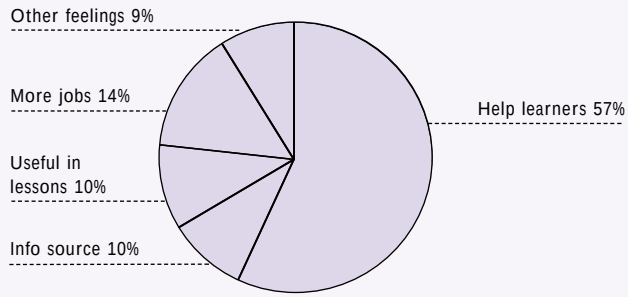


Figure 7.4: Reasons why schools start using computers

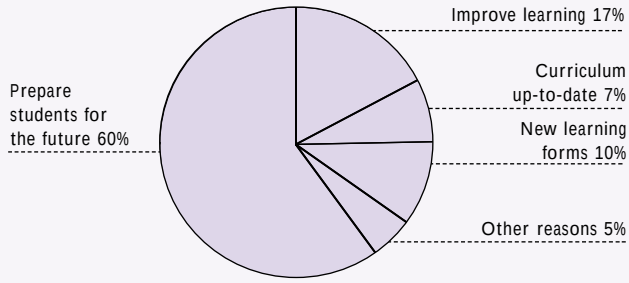
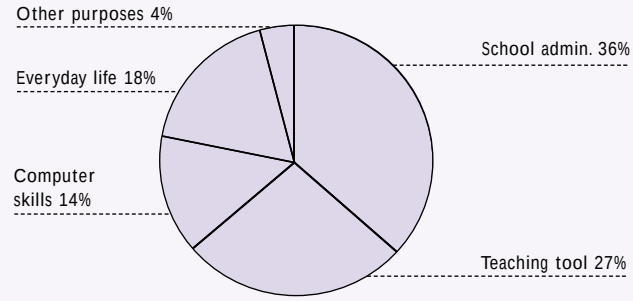


Figure 7.5: Purposes for which computers would be used (First choice)



Human resources required to develop and manage computer facilities

A significant proportion of schools indicated that the lack of suitably trained teachers is one of the factors that prevent schools from acquiring computer facilities. Three questions were included in Questionnaire B to get a better idea of the human resource base present in schools. Firstly, schools were asked whether there is a person or persons interested in developing and managing the use of computers in the school. As Table 7.6 shows, the large majority of schools (of all types and in all provinces) answered positively.

In a follow-up question, schools had to indicate the gender of the person(s) referred to in Table 7.7 as well as the position held by the person(s). The evidence showed that the majority are male (75%) and most are either a subject teacher or a subject teacher with management responsibilities (such as the deputy principal).

Schools were then asked to list the factors that prevent this person from developing the use of computers at the school. The results are similar to those previously given with lack of electricity, problems with space and lack of funding being the main factors.

3. Other in the figure refers to categories which received less than 5% support and were therefore included together into one category. This is distinct from schools who identified 'other factors' as a specific item.

Table 7.5: Grades that would receive priority when computers are introduced

	G1–G3		G4–G7		G8–G10		G11–G12	
	Yes Row %	No Row %	Yes Row %	No Row %	Yes Row %	No Row %	Yes Row %	No Row %
Type of school (recoded)								
Primary	37	63	74	26	4	96	4	96
Secondary	3	97	3	97	70	30	48	52
Combined	23	77	46	54	50	50	17	83

Table 7.6: Is there a person interested in developing and managing computers in the school?

	Yes		No		Total
	Count	Row %	Count	Row %	Count
Type of school (recoded)					
Primary	245	87	36	13	281
Secondary	85	84	16	16	101
Combined	44	92	4	8	48
Province					
E/Cape	33	80	8	20	41
Free State	36	84	7	16	43
Gauteng	23	74	8	26	31
KZN	88	92	8	8	96
Mpumalanga	37	93	3	8	40
N/Province	92	90	10	10	102
N/Cape	9	82	2	18	11
North West	36	86	6	14	42
W/Cape	31	82	7	18	38

Table 7.7: Conditions and resources that must be in place before schools are able to start using computers

	Yes	No	Total
No specific conditions are required			
Count	27	426	453
%	6	94	100
Suitable room for computers			
Count	300	153	453
%	66	34	100
Access to electricity			
Count	265	188	453
%	58	42	100
Teacher with adequate training			
Count	320	133	453
%	71	29	100
All teachers must have some computer training			
Count	105	348	453
%	23	77	100
Sufficient funding for maintenance			
Count	203	250	453
%	45	55	100
Parental support			
Count	178	275	453
%	39	61	100

Another way of addressing the issue of computer provision is to shift the focus from the individuals responsible to the underlying infrastructure that is required before computers can be used in schools. Schools were asked to list the three most important conditions and resources that have to be in place before they could start using computers. The results are summarised in Table 7.7.

It is important to note that the majority of schools, by indicating the need for at least one teacher to be in place who has sufficient training to run and manage the computers (71%), show a clear concern with the present level of educator skills in this area. Of almost equal importance is infrastructure expressed through 66% of the schools indicating a need for classrooms suitable for computer use as a prerequisite. The absence of electricity and its effect on computer use is also highlighted in this table, with 58% of the schools indicating a need to have access to electricity before computers can be used. Very few schools (6%) feel that no specific conditions need to be in place before the introduction of computers.

Schools, outside funding and the community

Table 7.8 reveals that schools have received very little from businesses or other organisations regarding computer provision at their school. The evidence shows that only 13% of the respondents have been approached in this regard. Although the small number of schools that responded must be borne in mind, when these responses are considered in relation to the grouping variables some interesting observations can be made. As would be expected, schools in Gauteng, where there is the greatest concentration of capital, appear to have received the most attention (65%). On the other hand, in KwaZulu-Natal, one of the poorest provinces, only 3% of schools indicated that they

Table 7.9: What have donors offered schools?

		Yes	No	Total
Donation of computer hardware				
	Count	14	439	453
	%	3	97	100
Donation of computer software				
	Count	8	445	453
	%	2	98	100
Teacher training courses				
	Count	16	437	453
	%	4	96	100
Leasing of computers				
	Count	19	434	453
	%	4	96	100

had been approached.

Of even greater concern however is the picture that emerges when schools were requested to specify the nature of what had been offered to them by outside organisations. Table 7.9 shows that within the small group of respondents who have been approached, 4% indicated that this approach had been in the form of the option of a leasing agreement between a school and a specific company. Such an arrangement is different from donations of hardware or software, which had only been offered to 3% and 2% of the schools respectively. Similarly, despite the need expressed earlier by schools for educator development in this area, only 4% of the schools indicated that training courses had been offered to their teachers.

In attempting to assess the extent to which access to computer resources may be available to schools in the surrounding community, schools were requested to indicate whether any of the groups in schools had access to computers at home, at another school, at another resource within the community or anywhere else. The responses are shown in Table 7.10.

The table shows that, in general, access outside schools is extremely limited, particularly for learners. Only 5% of learners have access to computers at home and only 1% are able to make use of computers at another school in the community. A slightly higher percentage of school managers and teachers have access to computers at home (17% and 15% respectively) and at another school (6% and 5% respectively). Access to ICTs at community centres is also limited, with teachers having the most access (7%).

Throughout this chapter issues have been highlighted which point to the problems which schools have, or are likely to have in acquiring and developing ICTs at their school. An analysis of what can be regarded as the most important issues for consideration in facilitating effective 'start-up' in schools is addressed in Section C.

Table 7.8: Approaches by the private sector or other donors

	Yes		No	
	Count	Row %	Count	Row %
Type of school (recoded)				
Primary	36	14	225	86
Secondary	9	10	81	90
Combined	6	14	38	86
Province				
E/Cape	3	9	30	91
Free State	7	18	33	82
Gauteng	15	65	8	35
KZN	3	3	87	97
Mpumalanga	4	11	34	89
N/Province	8	8	93	92
N/Cape	3	30	7	70
North West	3	7	38	93
W/Cape	9	29	22	71
Ratio of learners to educators (categories)				
33 and less	31	16	163	84
More than 33	21	11	178	89
Total	**52**	**13**	**341**	**87**

Table 7.10: Access to computers outside of schools

		Yes	No	Total
Management – Access at home	Count	78	375	453
	%	17	83	100
Management – Access at another school	Count	27	426	453
	%	6	94	100
Management – Access at community centre	Count	29	424	453
	%	6	94	100
Management – Other access	Count	12	441	453
	%	3	97	100
Admin – Access at home	Count	22	431	453
	%	5	95	100
Admin – Access at another school	Count	16	437	453
	%	4	96	100
Admin – Access at community centre	Count	15	438	453
	%	3	97	100
Admin – Other access	Count	5	448	453
	%	1	99	100
Learners – Access at home	Count	21	432	453
	%	5	95	100
Learners – Access at another school	Count	6	447	453
	%	1	99	100
Learners – Access at community centre	Count	10	443	453
	%	2	98	100
Learners – Other access	Count	3	450	453
	%	1	99	100
Teachers – Access at home	Count	67	386	453
	%	15	85	100
Teachers – Access at another school	Count	24	429	453
	%	5	95	100
Teachers – Access at community centre	Count	32	421	453
	%	7	93	100
Teachers – Other access	Count	7	446	453
	%	2	98	100

Summary

- Nearly half (48%) of all schools in the sample without computers acquired electricity over the past three years; while nearly one quarter (23%) acquired additional classrooms during the same period. However, in respect to these improvements and acquisitions, schools in the Eastern Cape and Northern Province rated below the national average. Such an indicator reinforces the notion that these two provinces have the least resources in the country.
- Generally, schools that do not have computers also experience deficiencies in complementary technologies. Less than 20% of schools have VCRs, radios, tape recorders and slide and tape recorders. An exception were schools with overhead projectors (28%) and TVs (24%).
- The most important factors preventing schools from acquiring computers are an absence of electricity (28%), lack of funding (22%), insufficient building space (14%), a lack of available staff (13%) and poor security (6%).
- Positive feelings about the value of computers at schools without computers overwhelmingly overshadow the negative feelings. The positive feelings are associated with the provision of an environment for independent work and thinking among learners (86%) as well as giving them greater job opportunities (79%). Teachers also see computers as an important source of information to access resources not available to them in school (77%). The most prominent negative feature was the belief that the introduction of computers would increase teacher workloads (18%).
- The most popular reason given about why a school would start using computers was because it would help prepare students for the future (60%). Primary schools believed that computers would be most beneficial to learners in Grades 4 to 7 (74%). In secondary schools it was suggested that learners in Grades 8 to 10 would receive priority if computers were introduced at schools (70%).
- At least one or more teachers at just over 80% of schools in the sample would be interested in developing and managing the use of computers at schools if they became available. The majority of these individuals are male (75%). Most are either a subject teacher or subject teacher with additional management responsibilities (such as the deputy principal). However, schools nonetheless expressed a need for necessary conditions and resources to be in place before they would be able to start using computers. A teacher with adequate training was one of these prerequisites.
- Private sector initiatives to assist schools without computers have been marginal and only 52 out of 393 schools (13%) reported being approached for this purpose. Though numerically few, schools in Gauteng (65%), Northern Cape (30%) and Western Cape (29%) witnessed proportionately more overtures along these lines. These included donations of computer hardware (3%), donations of software (2%) and leasing of computers (4%). Only 4% of schools indicated that training courses had been offered to their teachers (this aspect is explored in more detail in Chapter 9).
- Within the sample population, access to computers by school managers, teachers and learners at places other than the school are extremely limited.

8

NGOs and the use of ICTs at schools in South Africa

This chapter discusses the survey of the NGO environment[1]. It provides an overview of the nature and scope of NGO contributions to the growth and development of ICTs in South African schools. The impact of the work of 17 NGOs is then outlined along with issues around the funding and sustainability of these projects. By the end of the chapter, a picture emerges of the factors that assist and those that hinder NGO work. Details about the individual NGOs are included in Appendix C.

Overview of NGO involvement in the promotion of ICTs in schools

Scale of work

Table 8.1 shows the geographic scale of operations undertaken by the 17 NGOs that were identified as the main ones contributing to the use of ICTs in schools. Eight of these NGOs aim to operate nationally, but their actual involvement differs markedly from province to province; five of the NGOs focus their work on a specific region or province and the remaining four work in very localised areas.

There seems to be a more significant NGO presence in Gauteng and the Western Cape than in other provinces. The Eastern Cape and KwaZulu-Natal are next in line, while NGO initiatives in the remaining provinces appear to be in the infancy stages. While this picture is not unexpected, it is interesting to note that greater NGO involvement in the Western Cape and Gauteng mirrors the better ICT resource levels in these provinces as indicated in Chapter 6.

Nature and scope of work

The nature of NGO contributions to the use of ICTs at South African schools can be grouped into the following broad categories, with the first three receiving slightly more emphasis:

- provision and maintenance of physical infrastructure and networks.
- development and maintenance of contacts between interested individuals.
- professional development of teachers.
- resource development.
- research and consultancy.

Provision and maintenance of physical infrastructure and networks

This category includes provision of equipment to schools, repair and maintenance (on a technical or advisory level), and involvement in extending computer networks. The latter may involve networking computers in a school to form a local area network or connecting school computers to the Internet. NGOs have different focuses and approaches in this area. For example, Netday Association concentrates on advising schools on the steps involved in setting up a computer laboratory. It aims to act as an intermediary and advisory body that coordinates business sponsorship or contributions, the services of volunteers and the school's

1. This chapter is based on a report prepared by the South African Institute for Distance Education (SAIDE) for this EPU study.

Table 8.1 Geographic scale of NGO operations

Organisation	E/Cape	Free State	Gauteng	KZN	Mpumalanga	N/West	N/Cape	N/Province	W/Cape	
National (Intention)										
Computer Society of South Africa	✓	✓	✓	✓					✓	
Media in Education Trust			✓	✓						
Netday Association	✓	✓	✓	✓	✓	✓			✓	
Networking initiatives (TAD, Edufax, and NITF)	✓	✓	✓	✓	✓	✓	✓	✓	✓	
ORT-STEP	✓		✓	✓					✓	
SchoolNet South Africa	✓	✓	✓	✓	✓	✓	✓	✓	✓	
South African Schools Directory			✓			✓				
South African Institute for Distance Education (SAIDE)	✓	✓	✓	✓	✓	✓	✓			
Regional										
Eastern Cape Schools Network	✓									
Gauteng Schools Network			✓							
Mathematics Learning and Teaching Initiative (Malati)								✓	✓	
Mpumalanga Schools Network					✓					
Western Cape Schools Network									✓	
Local										
National Science and Technology Trust [2]		✓	✓							
Mamelodi MPCC			✓							
Siyabuswa Educational Improvement and Development Trust (SEIDET)					✓					
Stutterheim Education Trust	✓									

educational technology needs. The Western Cape Schools Network, on the other hand, acts as an Internet Service Provider for schools. It assists schools to get connected to the Internet, and hosts their web sites on its server.

Development and maintenance of contact between individuals

This focuses on sharing ideas and information on projects with people involved in promoting the use of ICTs in schools. This is done both through meetings and personal contact and using electronic distribution lists and information services. Major networking NGO initiatives include Edufax, the Telematics for African Development Consortium, the National Information and Technology Forum, and the Computer Society of South Africa. All of these have a focus that is broader than, but relevant to, the use of ICTs in schools. SchoolNet South Africa is the main national co-ordinating body. It plays a key role in assisting and monitoring regional school networks, as well as co-ordinating business sponsorship and liaising with government departments.

Professional development of teachers

NGO involvement in the professional development of teachers is mostly focused on teacher training. This includes short courses and workshops on the use of ICTs generally, as well as ways of integrating these technologies into the classroom. Many NGOs focus on training teachers about the basics of how to use computers. This may include very basic skills like word processing, using computers to support administration and management or how to use the Internet for collaborative projects. Other training courses do not have a specific computer focus. For example, ORT-STEP's teacher training is done in the context of teaching Technology as a learning area. Its module on ICTs is thus part of a larger course framework. This is also the only NGO that offers accredited courses to teachers. Like ORT-STEP, the Media in Education Trust (MiET) does not focus specifically on computers. Its training work deals with the use of a variety of media in the classroom.

A lot of teacher training is done through computer courses that are run at special training centres.[3] It is, therefore, very difficult to assess the extent to which skills learnt through such courses are used and integrated into the teaching environment at schools. SchoolNet South Africa has recognised the limitations of isolated short training courses for teachers,[4] and now aims to emphasise integration of technologies into the classroom environment. Malati is offering support to teachers at their schools rather than at training centres, although this is on a very small scale. The integration of ICT skills and resources into the curriculum is a key goal for this NGO.

The MiET develops materials for teachers with a focus on supporting the use of ICTs at

2. The National Science and Technology Trust have been classified as a local initiative. Although it works in Bloemfontein and Soweto, its work is directed to local centres and networks and is not located within a regional or national framework.

3. ORT-STEP, National Science and Technology Trust, SEIDET, and Stutterheim Education Trust all run teacher training courses from specially designed centres.

4. SchoolNet ran some teacher training courses between five and seven days in length.

schools. A recent example of this was the printing and distribution of materials to schools on the use of audio and video resources in the classroom that formed part of the teacher support materials for SABC School TV. Malati, like MiET,[5] is developing resources to be used by teachers to encourage integration of ICTs into the school curriculum.

A number of the web sites of regional school networks (notably the Western Cape, Eastern Cape and Gauteng) include ideas for teachers on using the web environment in lessons. Similarly, Netday produced a, *'How To'* guide for teachers as another professional development resource.

Resource development

From the above discussion, it is clear that the resource development overlaps to some extent with professional development. Resource development focuses on resources developed for use by learners or by learners and teachers.

Resource development remains a major gap in the activities of NGOs that are supporting the use of ICTs in schools. Within this sphere, the issue of the local content of resource development has become a key issue.[6] Malati has produced a rich resource of mathematics teaching and learning materials. This has been done through the work of South African educators who worked in topic groupings to collate resources from around the world and develop some of their own materials. The focus is specifically on the South African mathematics syllabus, and, as such, the resource developed is relevant and useful to the South African school community. SchoolNet South Africa, the Western Cape Schools Network, Gauteng Schools Network and Eastern Cape Schools Network have also compiled or developed some web-based materials.

On a different tack, the South African Schools Directory has had a broad resource development focus, assisting schools to develop web sites for themselves. Information about the school and its activities is compiled in a template, and hosted in a web-based database at the South African Schools Directory. In principle, this NGO aims to give South African schools a web presence, through which the school community can communicate and network. The public can access information relating to specific South African schools through this site. In practice, however, the South African Schools Directory is simply a subset of information stored in an American School Directory database. As such, local information is scant and information pertaining to the 'local' community for each school (such as weather and news) is limited to the United States of America and does not incorporate South Africa. This is a clear example of unbalanced local content development: minimal local information is collated or developed, and then simply appended to existing foreign material.

What is outlined here shows up the lack of local materials development and the fact that there is a clear need for investment in this area. Despite this however, NGOs are filling an important niche in this area, providing services and support to schools that would not otherwise be provided. The work of the organisations mentioned has clearly played a critical role in raising awareness about the importance of integrating ICTs into schools in South Africa and developing models for achieving this.

Research and consultancy

Some NGOs offer advice to schools about both technical and educational issues relating to the use of ICTs. Such advisory services may be done through telephonic or electronic communication, site visits, or on a more formal consultancy basis. The regional school networks, the Computer Society of South Africa and Netday Association all offer such advisory services. With regard to research, some NGOs simply track involvement and document their progress and experiences. Others have more

5. Whereas MiET materials are printed, the Malati materials are web-based. A number of the web sites of the regional school networks (notably Western Cape, Eastern Cape and Gauteng) include lesson ideas for teachers on using the web environment in classrooms. This could be seen to be contributing to professional development.

6. Some organisations outside the NGO sector have started some resource development for schools, but an analysis of these fell beyond the scope of this study. It is, however, interesting to note that many of these resource development initiatives are based at universities, or individual schools. See SchoolNet SA, 1998. Overview of Online Teaching and Learning Resources for a preliminary scan of online resource development projects. http://www.school.za/overview/tlr.htm.

Table 8.2 Summary of NGO objectives

	Physical Infrastructure and IT Networking	Human Networking Professional	Development of Teachers	Resource Development	Research and Consultancy	
National (Intention)						
Computer Society of South Africa	✓	✓	✓	✓		
Media in Education Trust			✓			
Netday Association	✓					
Networking initiatives (TAD, Edufax, and NITF)		✓				
ORT-STEP			✓			
SchoolNet SA	✓	✓	✓	✓	✓	
South African Schools Directory				✓		
South African Institute for Distance Education (SAIDE)		✓			✓	
Regional						
Eastern Cape Schools Network	✓		✓	✓	✓	
Gauteng Schools Network	✓		✓	✓		
Mathematics Learning and Teaching Initiative (Malati)			✓	✓	✓	
Mpumalanga Schools Network	✓	✓			✓	
Western Cape Schools Network	✓	✓	✓	✓	✓	
Local						
National Science and Technology Trust	✓		✓			
Mamelodi MPCC			✓			
Siyabuswa Educational Improvement and Development Trust (SEIDET)			✓		✓	
Stutterheim Education Trust	✓		✓	✓		

Table 8.3 Geographical distribution of organisational activities

Actvity	E/Cape	Free State	Gauteng	KZN	Mpumalanga	N/West	N/Cape	N/Province	W/Cape	
Physical Infrastructure and ICT Networking	1	4	3	4	2	2	1		3	
Human Networking	3	2	2	2	2	2	1		3	
Professional Development of Teachers	1	4	2	6	3	1		1	3	
Resource Development	1	3	1	3	1		1	1	3	
Research and Consultancy	2	1				2		1	2	
TOTAL	8	14	8	15	8	7	3	3	15	

rigorous research activities. For example, the Siyabuswa Educational Improvement and Development Trust, in partnership with the University of Pretoria, researches activities at the centre on an ongoing basis. Similarly, Malati conducts research into the effectiveness of its methods of using information technology in teacher education. The regional school networks also aim to include a research component to their activities.

A few NGOs conduct systematic research that is then shared with an external audience. For example, SchoolNet South Africa compiled an analysis of Internet connectivity at schools based on the School Register of Needs, and has categorised a compilation of online materials developed in South Africa.

Table 8.2 summarises the objectives of NGOs surveyed, in terms of five categories described. It is important to note that this reflects what NGOs aim to do, but is not necessarily a representation of what is actually currently being done.

The matrix above provides some indication of the geographical distribution of the organisational activities discussed. The numbers in each cell represent the number of NGOs engaged in particular organisational activities in each respective province. For example, there is one NGO contributing to physical infrastructure and ICT networking in the Eastern Cape, while one focuses on this explicitly in the Northern Cape and none in the Northern Province. Most NGOs aim to

work in all five categories identified above, but then admit to having focused only on one or two areas. This tends to create the unjustified impression that NGOs are not having the desired impact, as the actual scope of their work is narrower than their articulated objectives. More collaboration between organisations with clearly focused objectives may result in more balanced partnerships, ultimately having a greater effect.

NGO involvement in school ICT networks

Currently, there are four provincial school networks under the umbrella of SchoolNet SA. These are in the Western Cape, Gauteng, KwaZulu-Natal, and the Eastern Cape. The school networks of both the Western Cape and Gauteng are considered to be well established, with the Western Cape Schools Network (WCSN) being viewed as a model for other provinces.

The Western Cape Schools Network (WCSN) has the highest levels of Internet connectivity for its schools. Initially, the WCSN focused primarily on the provision and maintenance of physical infrastructure and ICT networking. It functions as an Internet Service Provider and offers technical support and advice to schools. More recently, its attention has turned to issues of content development, professional development of educators, and research and evaluation. It has a strong working relationship with the provincial education department. Its success has been attributed to a number of factors. These include: the relative density of schools around several urban centres; relatively high levels of resources within schools and communities; and a provincial education department that actively promotes the use of ICTs in schools.

The Eastern Cape, KwaZulu-Natal, the Northern Province, and North West are considered to have emerging school networks. SchoolNet SA anticipates that, in the remaining provinces – the Free State, Mpumalanga, and Northern Cape – it will soon have to establish school networks and relationships with provincial education departments and other NGOs.

Relationship between NGOs and the State

In general, relationships between NGOs and the State are healthy in the ICT sphere. Many factors appear to contribute to this, including the existence of facilitative policy frameworks, pro-active and generally inclusive activities by the Department of Education, and awareness on the part of NGOs of the importance of cultivating healthy relationships with government.

The Department of Education has endeavoured to create an enabling environment for any organisation supporting the use of technologies in schools. The policy documents of the Technology-Enhanced Learning Initiative (TELI) create a policy framework within which such initiatives can take place. The Department of Education does not see itself as implementing projects on a large scale (either in terms of infrastructure, content or professional development). Instead, it has sought to support all organisations engaged in implementation and to play a coordinating role for different initiatives.

On a national level, there is a well established relationship between the National Centre for Educational Technology and Distance Education and SchoolNet SA. The Department of Education has been involved in the conceptual development of this national co-ordinating NGO and participated in its launch. As many of the NGOs work with or through SchoolNet it is encouraging that this state-NGO relationship is well established.

At the provincial level, once again the WCSN provides evidence of a highly co-operative working relationship with the provincial department of education. The WCSN offices are housed in provincial government buildings

and the provincial network of teacher centres is used for training initiatives. Programmes and activities offered at teacher centres have a clear focus on the development of ICT skills and, more recently, have included the integration of ICTs into the curriculum. The Western Cape Education Department's commitment to the use of ICTs in schools is seen to be a contributing factor to the success of the regional school networks in this province (this becomes more evident through the rest of the survey findings).

Other regional networks seek to work with provincial departments but these relationships are still emerging and are less established than in the Western Cape. The survey showed that provincial departments are playing an important role in helping to identify schools for pilot projects (like the World Links project of SchoolNet SA) and in communicating ICT developments to districts and schools.

While relationships between NGOs and the Departments of Education are, therefore, generally regarded as valuable, some problems were identified. For one organisation, the state's lack of funding and support for training teachers in technology education is seen as a critical problem. Government projects and programmes are generally slow to get started resulting in frustration by both NGOs and the schools themselves. These examples provide a reminder, therefore, that some improvements in the relationship between NGOs and the government can still be made in this area.

Evaluating the impact of NGO involvement in ICTs

Despite an interesting diversity of activity and wealth of developing experience in the NGO sector, it is painfully clear that NGOs have, to date, reached very few schools. Estimates of schools reached reflected in the case studies suggest that no more than four hundred schools have benefited from collective efforts of NGOs. With similar caveats, one can estimate that approximately one in 500 teachers have received some teacher training either in basic computer literacy or in integrating ICTs into the curriculum via NGOs. These rough estimates can be compared with estimated national figures of 27 000 schools and 400 000 teachers.

NGO initiatives therefore remain very much at the margins of educational social activity and seem quite limited in impact.

There may be a number of reasons for this among which would probably be limited funding for NGOs and lack of resources in schools. These problems are compounded by the fact that most initiatives are in their infancy and NGOs seeking to provide or support the use of ICTs in schools are still, in the main, relatively new in South Africa. Paucity of reliable information suggests that, for NGOs to have greater reach, more systematic monitoring of impact and effectiveness of initiatives is crucial. This might help in planning strategically for future interventions that are most likely to have the greatest impact, both within and beyond the NGO sector.

Financial sustainability

As has been indicated above, comparison of the stated objectives of many NGOs with actual accomplishments suggests that many have set unrealistically ambitious objectives. An examination of NGO budgets confirms that they are not sufficient to ensure the sustainability of initiatives. Most NGOs cite funding as the key factor hindering their work. Often the amount of money set aside for recurrent costs and for the professional development of staff is inadequate. Planning with modest targets and realistic deadlines are an urgent priority for NGOs working in this area. Some NGOs have already begun to successfully undertake such planning.

The problem of financial constraints is, however, not limited to the budgets of the NGOs themselves because a significant proportion of NGO work seeks to initiate processes in disadvantaged communities where they would not otherwise exist. The challenge of identifying or creating strategies that will enable these communities to take over and sustain these processes emerges. This is very difficult to achieve in areas where local economies are either defunct or very small. Expensive and unsustainable initiatives can deplete the limited resources of such communities leaving a negative impact. This can disempower and dishearten local communities. These problems are not easily resolved, and continue to create ongoing tensions for NGOs working in this field.

Sources of NGO funding

The vast majority of NGOs that promote the use of ICTs at schools rely on money from donor agencies or earmarked finances for their funding. Because such funding is not really sustainable over the medium to long term, the future of such projects can be quite fragile.

What is possibly more disconcerting than the current dependence on soft funding is that very few NGOs seem to be trying to find alternative forms of income, let alone building or exploiting them. This raises serious questions about sustainability.

Having said this, some other strategies of generating income emerged from the case studies, though they are still marginal. These alternative income streams are worth exploring because, although they may not currently be solutions, they may at least offer some lessons. Below are some examples:

- Siyabuswa Education and Improvement Development Trust (SEIDET) seek funding from the surrounding community and school parent body. SEIDET operates as a multi-purpose community centre, and charges users (students and members of the community) for its services and use of facilities.[7] In this example, the school parent body is willing to contribute financially to the educational improvement of their children.
- SEIDET also gets funding from research grants derived from its partnership with the University of Pretoria. Monies available for research and evaluation projects can potentially be tapped to benefit the schools studied.[8]
- The South African Schools Directory (SASD) has recently been incorporated into New Africa Technology Holdings and plans to use this private company's infrastructure, ICTs expertise, and social responsibility budget to cover its expenditure. In addition, SASD is planning to generate income through corporate sponsors for individual schools.
- Other NGOs also look to corporate sponsorship or 'adoption' of schools as a source of income,[9] yet only SASD has mentioned investigating online advertising for this relationship. Schools on the SASD site can choose to offer companies advertising space or a logo presence on the school web site. This could potentially be extended to hyperlinks or e-commerce opportunities, which may entice sponsors to establish long-term relationships with sponsored schools. Such use of the educational online environment will, however, need to be carefully planned, conceptualised, and monitored to avoid unsuitable commercial advertising or exploitative exposure for learners who use the site as an educational resource.

Organisational sustainability

Many NGO initiatives rely strongly on the commitment and energy of individuals for their existence. In fact, most NGOs cite the commitment and enthusiasm of staff as a

7. The Mamelodi Community centre generates funds in a similar manner.

8. An additional example of using research partnerships as potential sources of income is the SABC Education Television pilot study. In 1999, a number of South African primary schools were given television sets and video recorders, through a partnership with Discovery Channel, and will participate in an evaluation of the new Schools Television Service.

9. For example, SchoolNet SA, Netday SA, Computer Society of South Africa.

primary factor contributing to the organisation's ability to work effectively. This dependence on the skills of particular individuals can affect the growth and development of an organisation when such individuals leave the organisation or when they become overloaded with work. In small NGOs, this can be disastrous because many initiatives in such organisations are built through personal relationships between an individual in the NGO and an individual in particular schools. Such relationships are seldom concretised or formalised, and are often lost when individuals leave organisations or projects.

Obviously, limited funding exacerbates this problem. However, reliance on the energy of a few individuals also reflects the paucity of skills in South Africa in this field. What is of some concern, however, is that this trend shows little sign of changing.

Strategic partnerships

Many NGOs cite funding agents as partners of their projects. Where one 'partner' is simply viewed as a source of funding and the other as recipient, the nature of the relationship is generally one of dependence. This is particularly true where relationships with the private sector have been established. While there is nothing intrinsically wrong with entering into such partnerships, motivations for setting these up seem generally to have been established somewhat uncritically, resulting in relationships that are unbalanced and unsustainable. Partnerships need to be carefully planned and considered, with the contributions from each partner clearly articulated and, wherever possible, of mutual benefit to both parties.

Relationships with business have been established for some projects, and these tend to be based on donations (financial or in kind). The Western Cape Schools Network has, for example, negotiated a relationship with MWeb in which its member schools are given reduced ISP rates. This enables the WCSN to generate some income from school membership (which includes ISP charges), while offering a competitive rate.

Sustainability of NGO activities requires systematic planning and sound decision-making approaches, yet many projects seem not to be underpinned by such planning. This is reflected in the wide discrepancies between stated objectives and achievements. More effective planning might, however, help to overcome or avoid some of these problems.

Factors that influence NGO work

Not all NGOs responded to the questions regarding the factors that hinder and enable their organisations to work effectively. However, those that did so, placed much emphasis on the role of staff, in particular the contributions of dedicated individuals. Staff commitment, enthusiasm, and knowledge of ICT issues were all mentioned as important factors contributing to the ability of NGOs to function effectively.

The interest and involvement of people at schools and from the community in general were also seen to be enabling factors. Some NGOs referred to this as the services of volunteers, while others cited teacher involvement or having identified and responded to community needs.

Many NGOs also viewed support from government through working relationships with the national and provincial Education Departments as well as the enabling environment created by national policy to be contributing factors. It is interesting to note this response emanates primarily from school networks, and some other NGOs noted it as a hindering factor.

Hindering factors

Funding is both the most frequently mentioned and most highly prioritised factor identified as inhibiting the functions of NGOs in this area. Skill and competence is another factor often mentioned. This relates, in part, to observations about the lack of national and sustained teacher development programmes for ICT use. The observation nevertheless refers to the scarcity of ICT skills in general.

Also mentioned was physical infrastructure, in terms of lack of ICTs and networking in schools. This is seen to have been exacerbated by a historically unequal distribution of resources, which has contributed to stark differences in access to such technologies. While this refers to access to physical infrastructure, it also relates to the previous point in terms of access to skilled people and financial resources.

Two NGOs, SchoolNet SA and the Western Cape Schools Network both mentioned that the rising costs of Internet connectivity and charges for Internet traffic were hindering schools' ability to use ICTs, and this in turn was inhibiting the work of NGOs. Another important point relating to infrastructure and access was highlighted by organisations in the Eastern Cape. Stutterheim Education Trust and Eastern Cape Schools Network both cited the wide dispersion of schools and poor roads in the province as hindering factors.

NGOs mentioned lack of government support primarily through the inability of various education departments' inability to commit resources to ICT-related initiatives. Specifically mentioned were the slow pace of government bureaucracy and its lack of support for teacher training.

Some NGOs claim that teachers are unreceptive to the use of ICTs in schools. This is particularly apparent when the intention is to shift teaching methodologies and simultaneously integrate the use of ICTs into the curriculum. Where this is the aim, a paradigm shift in terms of teaching and learning approaches is required. This is far more difficult to achieve than simply training teachers in basic computer use.

Theft, vandalism, and security of ICT equipment were also identified as problems. This does not seem to be a pervasive issue, but is nevertheless a critical consideration for the implementation and sustainability of technology infrastructure in schools.

Conclusion

This chapter has provided a brief overview of the nature of NGO contributions to supporting the use of ICTs at schools in South Africa. It provides some general indication of key areas in which NGOs are providing support to schools. A number of challenges have been identified that NGOs in this sector will have to confront in order to strengthen their role in supporting the use of ICTs in schools.

9

Supply of ICTs to schools by the private sector

This chapter explores the role of the private sector in meeting the demand for ICTs at schools and for the professional development of teachers.[1] Commercial suppliers in South Africa were approached via telephone and a structured interview guide to find out what they provided to schools and some of the dynamics and characteristics of that market. It should be noted that it has been difficult to gather relevant data. In part this is because the schools market appears to be very fragmented, and not very significant in size. This is therefore not intended to be an exhaustive survey and the results reported here are not necessarily representative of all computer product and service providers to schools. Nonetheless, we believe the results are instructive and provide a context within which to evaluate the main body of results provided by this research project. An overview of the feedback received from the suppliers interviewed is provided in Appendix F.

Overview of the market

In other parts of the world the private sector show intense interest in the contribution that computers exert on education in schools and the preparation of schoolchildren for the information society. Examples in other countries such as the United States (which has the Schools Technology and Readiness Chart, ThinkQuest, etc.), Australia (the Australian White Paper on IT in schools), New Zealand (the New Zealand national survey of computers in schools) and Malaysia (the Malaysian Multimedia Super Corridor lead project on Smart Schools), illustrate the tangible actions that are being undertaken in developed and developing countries alike to monitor the role of ICTs in schools.

In South Africa, the main studies on the issue of computers in education have been led by the government and NGO sectors. Initiatives of note include the national TELI initiative, the Western Cape Telecommunications Project, Cyberschool, SchoolNet SA and the regional schools networks.

By contrast, our investigations showed that South Africa's private sector has only just begun grasping the opportunities afforded by in schools. Software suppliers such as Microsoft, Corel, Symantec and Adobe are in the forefront, offering attractive deals to schools. As regards networking products, Novell and Cisco offer school licensing at reduced rates.

We have, however, not found any major suppliers, distributors or retailers of computers that have specifically targeted the primary or secondary schools educational market. Nor have they devised creative ways of exploiting this market. This may be due to the low profit margins associated with the sale of PCs and negative perceptions about the school environment as a viable market.

The lack of knowledgeable personnel in client organisations creates some difficulties for suppliers. This lack of skills, coupled with limited budgets, seems to discourage the involvement of commercial suppliers.

1. This chapter reflects the findings of an investigation undertaken by Jonathan Miller of Miller Esselaar & Associates for the purposes of the study.

As is noted is Chapter 6, school fees, computer levies and fundraising events are the main sources of funding for computers. Schools therefore have to rely on small and possibly uncertain cash flows. The frequent comment from computer suppliers and some of the larger retailers is that schools seek out the cheapest deals, relying where they can on parents, governing bodies, friends of friends etc., to make their limited funds go as far as possible.

In many cases this is of course shortsighted. There is no continuity in branding and support policies, inadequate provision made for maintenance, there is over-reliance on a particular subject teacher for ongoing management of the computing facility and so on. One supplier of sophisticated communications equipment noted that he had to deal with teachers who might be adept at wordprocessing but had insufficient training to make effective networking decisions for their schools.

The role of governing bodies was often mentioned. In some cases schools benefit from knowledgeable and far-sighted governing bodies that provide excellent guidance and support for the ICTs effort. In others they rely on one or two parents who may regard themselves as 'talented amateurs' and perhaps have a contact in the computer business. There could be many opinions on a governing body. As one supplier said, some governing bodies are from heaven and others from hell! Problems also arise when the children of the computer champion at the school graduate and leave the school. These champions are inclined to change the orientation of their interests as new issues confront their children in different situations.

This highlights the need for teacher training. While the interviews indicate that Computers4Kids, Futurekids, K-Net and New Horizons all offer teacher training in one form or another, as do some education departments, the training appears to be limited in scope and focused on basic applications training.[2]

As shown in Chapter 6, the lack of available staff to use computer equipment and software is the most important inhibitor to more effective use of computers. Since 73% of schools in this study with more than 10 computers have networks and file servers and are now also connecting to the Internet, special efforts will be needed to upgrade teacher skills in those areas.

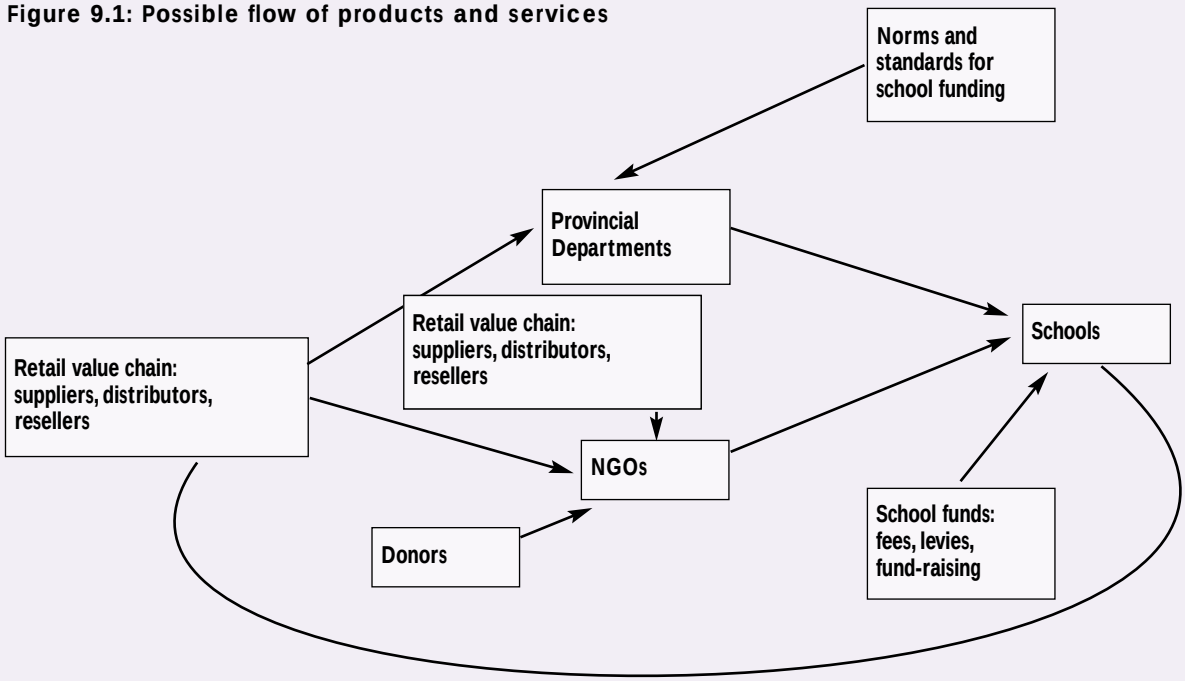
The outsource option

A model used by some schools is to outsource some or all of the computer planning, installation and maintenance in schools, together with teacher and student training. For the great majority of schools that have very limited human capacity in computers and cannot afford to have full-time staff managing their computer operations, this is an attractive model, largely adopted by Futurekids and other players like Computers4Kids and K-Net. However, it too has disadvantages. It is not easy to delegate local responsibility for integration of computers into the learning process. Nor is it easy for external agencies to tailor their particular philosophy and recommendations to the specific plans and evolutionary trajectory of particular schools. This is particularly the case with organisations such as Futurekids that use models developed elsewhere in the world. Futurekids are, however, developing a curriculum to cater for the needs of the local market.

Many of the larger business organisations approached are also active in the social responsibility arena. NGOs like NetDay, the Computer Society, SchoolNet SA, The Learning Channel, etc. all receive donations in cash or kind to fund their operations. International donors interested in helping

2. The Western Cape Education Department moved away from applications training some time ago and concentrates on the use of the computer as a tool in subject teaching, and the integration of applications into specific subject areas.

Figure 9.1: Possible flow of products and services



education, target NGOs rather than individual schools or commercial suppliers and then hold the NGO accountable for effective application of the donations. This model may be a valuable one for the great majority of schools struggling to build capacity in general and computer capacity in particular. Also since NGOs are working with several schools at once, they are in a position to negotiate bulk orders with dealers and suppliers.

Provincial education departments through district structures also seem be in a good position to act on behalf of schools and encourage business interest. For instance the Free State Department of Education has a well-worked out set of procedures for building partnerships with commercial ventures. With the notable exception of the Western Cape, the major problem is the lack of substantial allocations from the provincial education budgets to computer-related facilities and professional development.

Possible models for flows of products and services

Figure 9.1 brings together some of the elements to consider in relation to the provision of ICT facilities to schools. The two major sources of equipment are the retail chain and local and overseas donors. The latter could be individual businesses providing funding or disposing of redundant equipment, or donor agencies such as the World Bank, IDRC, etc. As mentioned above donor agencies tend to work via NGOs.

The retail chain starts with suppliers of equipment and software, either locally manufactured or imported products. Where there are special discounts applicable to schools they are applied through the distribution chain. Distributors such as FSA for example are able to offer academic discounts on software that are passed on to purchasers. Depending on the supplier and products concerned, certain conditions may apply, such as being registered as an academic user before the special deal is applicable. At this stage, most of this retail business appears to be directed to schools. Some NGOs purchase equipment for deployment to schools, and with the exception of the Western Cape Telecommunications Project, there appears to be no direct acquisition of ICTs for schools by provincial departments.

The role of the provincial departments

appears to be to offer advice through subject advisors, pass on information as to preferred suppliers nominated at the national level, communicate with NGOs and run teacher training centres. One respondent to this study has, however, noted that 'the efforts of provincial departments are haphazard at best and really non-existent at worst.' In due course, the provinces should play another role in ensuring that the *Norms and Standards for Schools Funding (1998)* are observed in the ICTs arena as in others.

The schools ICT market appears to be very fragmented as illustrated in the diagram. While academic discounts and pricing based on national tender approvals are available to all schools, not all schools in all provinces have the relevant information. Even if they do, individual schools are presented with a dilemma. Do they 'buy into' such national arrangements and make application via retailers who are part of a national distribution chain, or do they take advantage of local knowledge and suppliers. Often, in the short term, local costs could be even lower than those available from a national supplier, who has to build in contingencies for follow up support. At least one local supplier we spoke to assembles PCs at a very good price. There is also a case to be made for supporting local commerce and industry rather than seeing schools' funds flow to a national firm headquartered far away. A relationship with a local supplier should, at least in theory, go along with a support relationship. The disadvantage is the relatively higher risk of small local suppliers going out of business, or 'cutting corners.' Also a large national 'brand name' supplier is, again in theory, in a better position to offer special academic deals.

It seems that there is an opportunity, however, for the provinces to play a much stronger role as intermediaries in the supply chain. One of the important gaps that needs to be filled is more accurate and ongoing estimation of the total market for hardware, software, services and training. The provinces, through their district structures, should be in a good position to assess the nature and size of demand for ICTs in their schools and put a value on that demand over, say, the next three years. (They should also be able to assess and advise on the decision-making processes that schools use to choose suppliers and buy equipment.) They can then invite proposals from suppliers at a provincial level, including price, support terms and conditions, local reseller chains, etc. All schools in the respective districts should thus be in a better position, perhaps with the assistance of the ICT advisors where they exist, to get the best possible deals, with greater assurance of compatibility with other schools and continuity of support.

Conclusion

This chapter briefly explored the supply chain for schools' hardware and software. While there are many 'good deals' for business-oriented software packages, there are very few for hardware, telecomm equipment and connectivity. Where there are special arrangements for software, they tend to be based on a minimum number of 'users,' and that number can be large by South African standards. (There is some indication, however, that major suppliers are now structuring deals that suit this market in particular.) The general impression of the schools market for ICT products and services is that it remains very fragmented and individual schools act 'on their own'. Given very limited budgets, they tend to take a short-term view of ICT acquisitions and go for the best local deal rather than buying branded products with maintenance and support bundled in.

Based on a simple model of the supply chain, it is noted that the provincial departments could play a strong role in

negotiating with suppliers who are willing to make longer-term arrangements for schools at competitive prices. This is along the lines of existing national procurement policies for schools, which presently do not target ICTs in particular. In similar fashion, schools could organise themselves into local consortia to increase their buying power. The ICT subject advisors in provincial education departments could play an important part in such a structure. In addition to price and quality benefits to individual schools and educational authorities, an organised approach would have other benefits such as standardisation of hardware and software platforms, enabling more effective sharing of educational resources across schools.

10

Material and infrastructural factors that enable or restrict the start-up of ICTs in schools

As stated in the introduction, Chapters 1 to 13 provide a synthesis of the main findings of the report.

The aim of this chapter is to provide an account of the various material conditions and infrastructural concerns that are linked to effective startup of ICTs in schools. A detailed comparison of schools with and without computers shows how the latter group is disadvantaged in several ways that make effective start-up nearly impossible.

One of the key findings of this study, perhaps not surprisingly, is that there is a strong correlation between the location of schools in the broader social and economic context and the level of resources they have. This location tends to shape the provision of educational materials, the available 'human capital' and the propensity to provide education adequately, including effective use of ICTs. Poorer schools tend to be overcrowded with insufficient educational resources and little prospect of escaping this position. Schools that have successfully acquired ICTs for teaching and learning appear to enjoy more favourable conditions in this regard.

Schools that are unable to acquire the basic material resources for learning are not likely to be successful in acquiring ICTs for use in teaching and learning. Similarly, schools that meet the necessary conditions for the use of ICTs in the teaching and learning process do not show the capacity to do so without support and intervention from outside agencies. These agencies include the national and provincial departments of education, businesses and NGOs as well as other schools that can provide material and conceptual assistance. Such schools include those that have successfully adopted ICTs and use them to a maximum capacity in the classroom.

Favourable conditions encompass a multitude of enhancing conditions and capacities. The most prominent appear to be relatively smaller class sizes, the ability of parents to meet the additional financial demands involved in acquiring and maintaining ICTs and the ability to integrate ICTs effectively into the school routine, thereby creating a viable and sustainable culture around these new technologies.

In the discussion that follows we compare the situation of schools with and without computers in an attempt to reach a more detailed picture of the conditions that enable or restrict the startup and use of ICTs.

Schools without computers

It is important to examine the profile of schools without computers in some depth as it provides us with an important minimum benchmark against which to compare other stages in ICT provision and use. Given the

Figure 10.1: Technology resources (levels) by ratio groups[1]

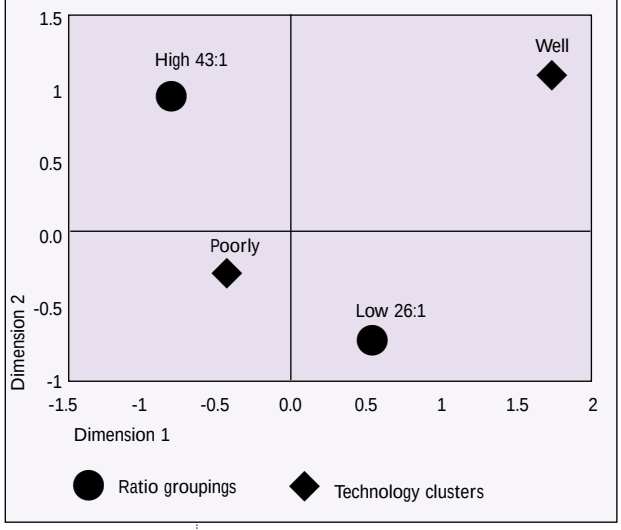
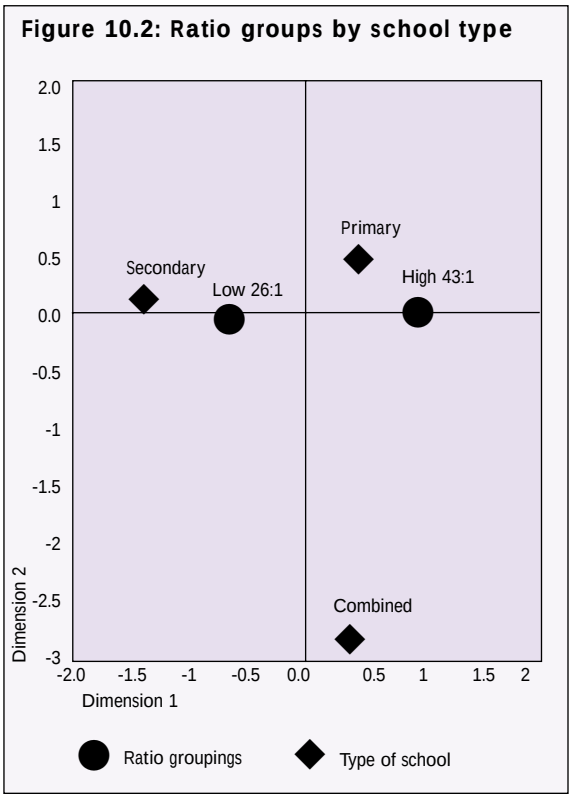


Figure 10.2: Ratio groups by school type



1. Throughout Section C a number of diagrams are used which provide a visual representation of the correlations between different variables or indexes. The diagrams show the relationship that exists when specific clusters of schools (e.g. schools with high or low pupil to teacher ratios) are compared with other clusters (e.g. schools with high or low levels of technology resources). The diagrams show this relationship plotted on a graph. To read the graph it is important to look at where the shapes (circles and diamonds) that represent a cluster are found in relation to the other shapes. Focus either on the horizontal or vertical axes that separate the graph into upper or lower quadrants or left or right quadrants. If two shapes are located close together on the same side of the graph this tells us that there is a strong correlation between these two clusters, i.e. that schools which fall into the cluster of those with a low teacher to pupil ratio also tend to fall into the cluster with higher levels of technology. So these graphs should be read by looking at the proximity of the different clusters to each other.

limited data on these schools in the HSRC database (1996), with regard to resources, it was decided to use learner to teacher ratios as the best proxy variable of general levels of learning and teaching infrastructure.

Among the schools with no computers, two groups were generated through cluster analysis: schools where learner to teacher ratios are relatively high (43:1) and those where the ratio is substantially lower (26:1). Most of the sample (60%) were classified in the low ratio group; the remaining (40%) in the high ratio group.

In making use of learner to teacher ratios, it is important to note that, as discussed in Chapter 5, ratios within and between provinces may differ considerably. The figures used in the study reflect the average learner to teacher ratio for that particular group of schools.

Through cross-tabulating the ratio groupings with other resource indicators, the following results were obtained. Schools in the high learner to teacher ratio group (43:1) are:

- less likely to have power supply or wiring in the schools.
- less likely to have acquired electricity after 1996.
- less likely to have acquired a telephone connection recently.
- less likely to have built additional classrooms recently.
- tend to be primary schools rather than secondary schools.

From the survey, it was possible to create a (rough) index of technology resources (i.e. the level of technology resources which schools have). Schools had to indicate which of a number of 'technologies', such as TVs, VCRs, OHPs etc. they had. Again, through cluster analysis, two 'technology clusters' were produced: high and low clusters. The vast majority of schools in the sample (80%) were classified as the low-tech cluster, i.e. where not more than one of these items was available. The remaining 20% of schools were classified as the high-tech cluster. These schools on average have more than four of the items in the technology list. The next step was to look at the cross-tabulation of the ratio groups with the technology clusters. Figure 10.1 presents this correlation.

The diagram shows clearly that:

- Schools with higher learner to teacher ratios (hence larger classes) feature nearer

to schools that have poor resources.

- Schools with low learner to teacher ratios (hence smaller classes) feature nearer to schools that have comparatively better resources.

Further analysis reveals that a comparison of learner to teacher ratios at schools by the school type (primary, combined or secondary) shows that among schools that do not have computers, large class sizes and high learner to teacher ratios predominate in primary schools. In secondary schools, class sizes and learner to teacher ratios tend to be lower. The results of the correlation are shown in Figure 10.2.

By combining the information on the technology clusters and the learner to teacher ratio clusters an *Index of Resources* was constructed with three levels: low, medium and high. When schools in the sample were organised into these three levels, the picture is shown in Figure 10.3.

The *Index of Resources* was subsequently cross-tabulated with a two-level grouping of factors that inhibit the acquisition of computer facilities in the school. This grouping, divided into those schools that listed a few inhibiting factors (slightly more than 2) and those that identified many inhibiting factors (more than 5).

From Figure 10.4, it is clear that schools which are classified as poorly resourced identify a greater number of factors as inhibiting their acquisition of computer facilities. The opposite is also true: schools that are categorised as highly resourced, on average identify a few factors inhibiting their capacity to acquire computer facilities. The graph provides an interesting correlation and one which would be expected since schools that are located in the middle with regard to the *Index of Resources* also show an equivalent number of hindering conditions (i.e. between few and many) that prevent them from acquiring computer facilities.

Figure 10.3: Distribution of resourcing groups

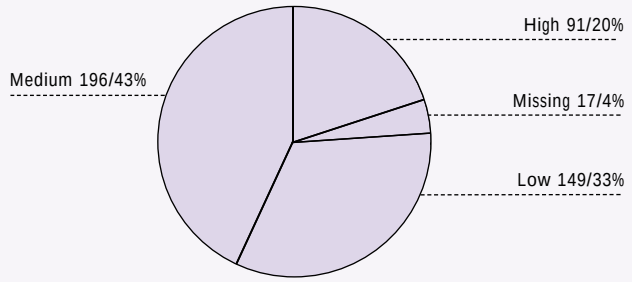
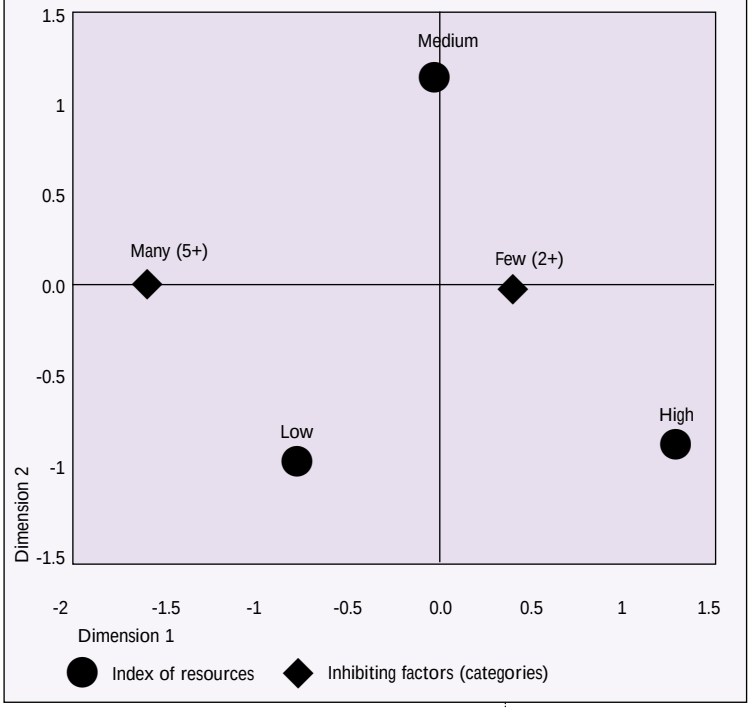


Figure 10.4: Factors preventing school from acquiring computer facilities



Schools with computers

A similar process was followed with the sample of schools with computers. In this case more information was available. An *Index of ICT Resources* was constructed through a cluster analysis on selected variables (i.e. Pentium processors and laser printers). Clusters for secondary and combined schools were combined to create smaller clusters. In an attempt to create another proxy variable for resourcing levels of schools, the ratio of learners to educators was selected once again.

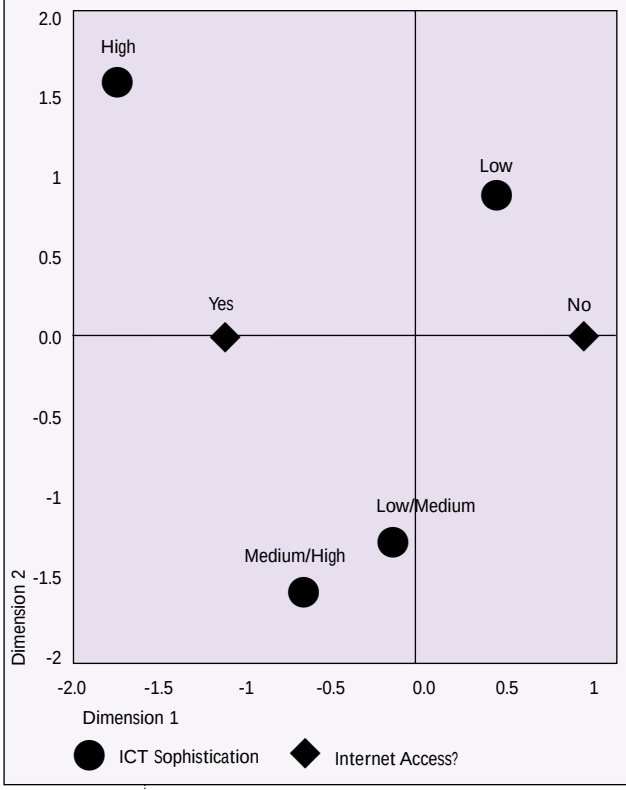
Two categories of schools were generated: Group 1 with an average ratio (or mean) of 30 learners to educators (high ratio group; n = 231)[2] and Group 2 with a mean ratio of 19

2. n = the number of schools which fall into this group.

Table 10.1: ICT sophistication by Pentiums and laser printers

IT sophistication		Pentiums in use	Number of laser printers
Low	Mean	5.09	1.76
	N	296	174
	Std. deviation	4.46	1.47
Low/Medium	Mean	8.99	1.86
	N	226	134
	Std. deviation	7.48	1.47
Medium/High	Mean	29.84	2.22
	N	68	55
	Std. deviation	11.54	1.42
High	Mean	43.80	3.66
	N	87	77
	Std. deviation	13.26	2.50
Total	Mean	13.85	2.18
	N	677	440
	Std. deviation	15.67	1.82

Figure 10.5: ICTs sophistication by Internet access



learners per educator (low ratio group; n= 446). This newly created variable was then cross-tabulated with the Pentium clusters.

The results showed that there was a moderately strong correlation between the Pentium clusters and the ratio groupings.[3] It was therefore decided to re-code the resultant categories into a new variable. A regrouping of the variables produced a fourfold classification that we have termed *ICT Sophistication Index* with four categories: low, low/medium, medium/high and high. The mean number of Pentiums and Laser Printers for these four categories is presented in Table 10.1.

The table shows that there is a clear relationship between level of ICT sophistication and the mean number of Pentiums in use in a school, but also between level of ICT sophistication and mean number of laser printers in use. When the *ICT Sophistication Index* was compared to other indicators of sophistication such as access to the Internet, a similar picture emerged.

Figure 10.5 shows a strong correlation between ICT sophistication and Internet access.

Figure 10.5 also shows that there is a strong correlation between low ICT sophistication schools and the absence of Internet access. Furthermore, moderately strong correlations were obtained between ICT sophistication, the use of file servers and computer networks, as well as the proportion of teachers with e-mail facilities at home. In order to simplify the Index, and because visual inspection has shown that the low/medium and medium/high categories sometimes cluster close together, it was decided to combine the two middle categories with a resultant 3-category index: low, medium and high levels of ICT sophistication.

From the results presented it is clear that there are a range of conditions that have contributed to the accumulation of ICT-related

3. A highly significant Chi-Square (Chi-Square = 108.077; p<.000; phi coefficient = 0.371)

resources that have enabled schools in particular instances to maintain a relatively high level of ICT sophistication. Schools have been able to retain these resources by constant renewal and upgrading. These appear to have been generated largely through parental contributions and fundraising initiatives. Schools with higher levels of ICT sophistication also tend to offer Computer Studies as a curriculum subject with a dedicated Computer Studies teacher.

As is to be expected, given the first level of analysis presented in Chapter 6, the level of ICT sophistication correlates strongly to the date when schools started using computers. Schools that started using computers before 1990 generally tended to be associated with high levels of ICT resources and therefore with a comparatively high level of ICT sophistication. This is shown in Figure 10. 6.

An interesting correlation confirms that schools which have many constraining conditions also have less success in generating funds, while schools that recorded having fewer constraining conditions achieved reasonable success in generating outside funds as is shown in Figure 10.7. Where these funds are generated from, i.e. the primary sources of funding, will be discussed in the next section.

Funding

The *ICT Sophistication Index* was also correlated with the sources and levels of funding schools were able to generate. Because the original questionnaire did not contain precise categories around which the funding sources of schools could be grouped, these had to be created. Schools that selected donation from parents, allocation from school fees or computer levy were grouped together and classified as 'Contributions from Parents'. This group was cross tabulated with 'school funding-raising activities'. Three new

Figure 10.6: ICT sophistication by start-up date

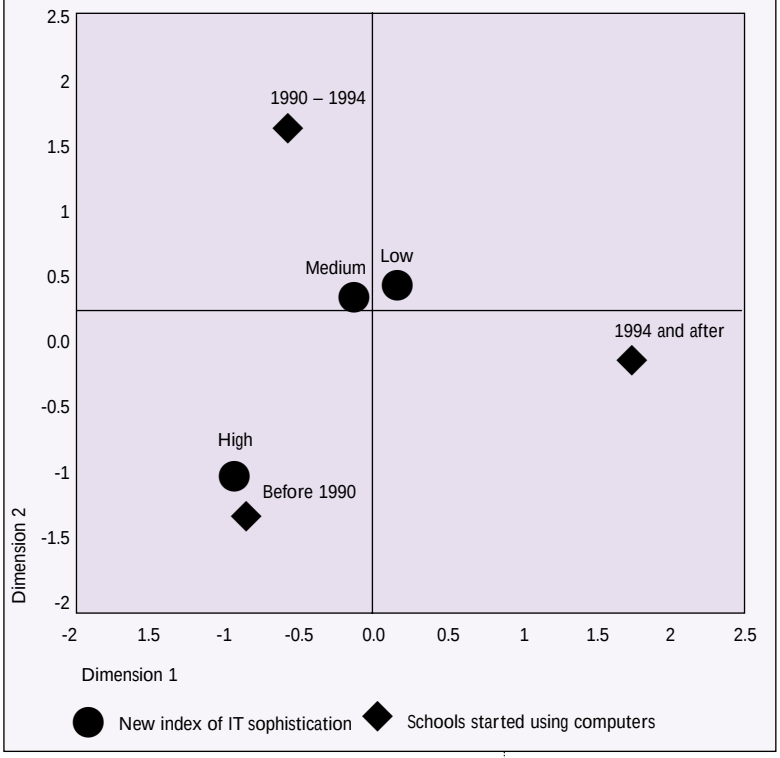


Figure 10.7: Constraining conditions by success in generating funds

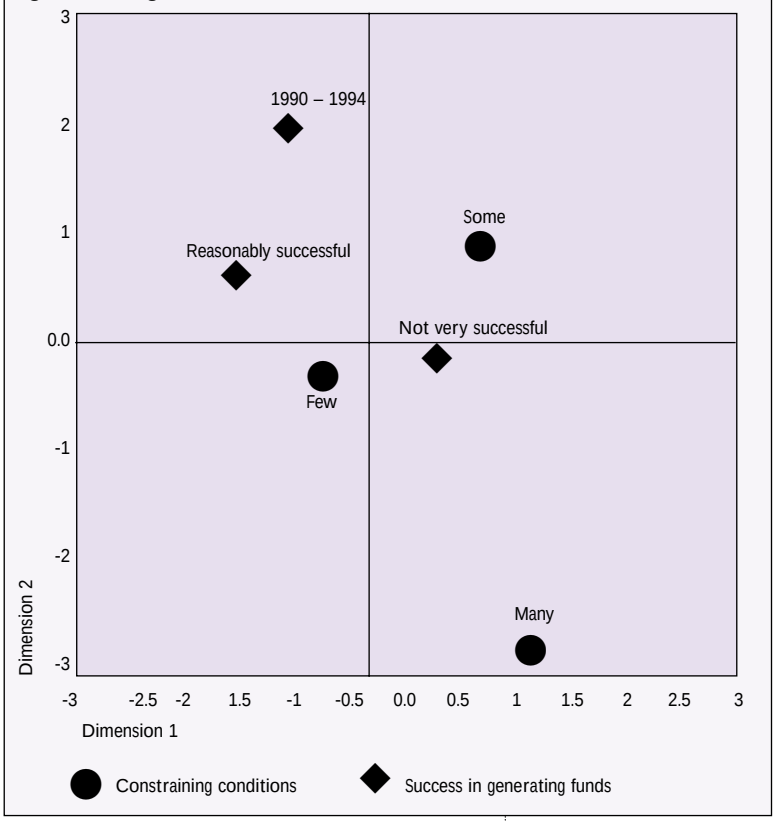


Table 10.2: Sources of funding

		Frequency	Percent	Valid percent	Cumulative percent
Valid	Fundraising	86	8.9	10.8	10.8
	Parents	375	39.0	47.2	58.0
	Parents and fundraising	334	34.7	42.0	100.0
	Total	795	82.6	100.0	
Missing	System	167	17.4		
Total		**962**	**100.00**		

categories were therefore selected from this, i.e.:

- schools that selected fundraising only (86 cases).
- schools that selected parents only (375 cases).
- schools that selected both, i.e. parents and fundraising (334 cases).

The results reveal that in schools that have a low index of ICT sophistication, fundraising played a more significant role as a source of funding for ICTs. However, schools within this category were also dependent to varying degrees on funds obtained from parental contributions. In schools that have a medium to high index of ICT sophistication, financial contributions from parents constituted the more important source of funding for new ICT resources at the school.

Other correlations showed the following:

Start-up date of schools

- Overall, funds that were obtained from both parents and fundraising were evenly spread across schools irrespective of their start-up date.
- Schools that started before 1994 were more reliant on contributions from parents for financing new ICT resources.
- Schools that started from 1995 onwards depended to a greater degree on fundraising activities.

Type of school

- Funding obtained through fundraising activities was generally prevalent in primary schools. However, in primary schools a large part of the funds that were used for new ICT resources were obtained from both parental and fundraising contributions.
- Funding obtained largely from parents was generally the norm in secondary schools.

It was argued in Chapter 5 that there is a growing tendency within schools for parents to share a greater burden of education expenditure. It was also pointed out that such expenditure is largely directed towards non-personnel expenditure where cuts in real terms have been most significant over the past three years. The recognition that this situation places poorer families at a disadvantage and reinforces a growing division between schools which are able to supplement their income from parent's contributions and those where parents cannot afford to contribute has been recognised and noted by the government. The sources of funding for ICTs and the link between parent contributions and higher levels of resources suggest that the provision of ICTs follows the same pattern as other non-personnel expenditure items.

Although the area of educator skill for the teaching of computer skills will be discussed later, it is important to note here that the survey also showed, particularly through the interview process, that where schools have a dedicated computer teacher, these were largely provided for through 'Governing Body posts' in the school. In this way, school fees are not only used to provide for the purchase and maintenance of computers but also for the provision of the necessary educator skills for effective computer use.

One school explained their situation as follows:

> *'At the moment we've actually only got 22 government teachers, and 15 governing body teachers…. but that's the extent to which I believe that you can't have big classes and the governing body go along*

with that, so – our fee structure is R370 a month. But I think I've convinced the parents that it's money well spent, because you can have every facility in the world, but put 50 kids in a classroom and you're not going to teach very well'.

There is no doubt then that while the provision, maintenance and teaching of computers remains an area of expenditure which is largely dependent on parent contributions, existing inequalities in the provision of ICTs will not only deepen but will also serve as a mechanism for increasing the divide between schools. The implications of this are enormous, particularly as ICTs develop as a means of accessing information and as a vital support mechanism for both educators and learners. These concerns were expressed openly by some of the more disadvantaged schools interviewed in the survey. They argued that even if they were able to raise money or receive a donation for new ICT resources, parents would be unable to pay for any maintenance that may be required and their teachers lacked the skills to be able to use the computers effectively.

What is heartening to see, however, is that, as noted above, schools which have a low index of ICT sophistication appear to have explored the route of fundraising in order to secure ICTs. It is also evident that this is a growing trend, particularly among those schools that started using computers after 1995.

Conclusion

The aim of this chapter has been to provide a descriptive account of the various material conditions and infrastructural concerns that are related to effective ICT startup. Through a comparison of schools without and with computers, we have shown how the former group is disadvantaged at a multitude of levels that make effective start-up nearly impossible.

The most basic infrastructural conditions (electricity, inadequate classrooms, insufficient security) are not present in large numbers of schools. Added to this are large classes, lack of funding to acquire computers and finally, a lack of available staff to manage ICTs.

The fact that larger proportions of schools do not meet these basic minimum conditions is an indication of the huge challenge that South Africa faces if it wishes to bring its learners into the information age. This challenge is coupled with the reality that where relatively high levels of ICT resources exist, these have largely been paid for through parents' contributions. This has important implications not only for the start-up of ICTs but also for the creation of equity.

11
Effective use of ICTs

One of the most important objectives of this survey was to investigate and describe how ICTs are presently being used in South African schools and the key factors that affect their use. Using this information, policy around ICTs in schools can specifically address the barriers and strengthen support for effective use.

The chapter begins by briefly reiterating the key issues that need to be considered when evaluating the effectiveness of ICTs. Then, in order to develop a picture of the context in which, and the different ways that, ICTs are applied in South African schools, four areas investigated by the survey are described and analysed in relation to the issues around effective use. The four areas are: the domains of ICT use; the purposes for which ICTs are applied in teaching and learning; types of software and frequency of use; and modes of application.

Following this an *Index of Usage* is developed to further analyse and synthesise the findings of the survey in relation to factors such as learner to teacher ratios; start-up date; Internet and e-mail access; etc.

What effective use of ICTs means

While the concept of 'effectiveness' in the use of ICTs is contested and clearly has different meanings for different people, in this study we have taken the position that effective use of ICTs adds value to the process of teaching and learning. As discussed in the earlier chapters, the value of ICTs ranges from equipping learners with skills and knowledge through ICT use, to enhancing the process of teaching and learning in the classroom. Effective use means making use of ICTs in such a way that their capacity to contribute positively to the process of teaching and learning is facilitated and supported.

> *'We feel very strongly about not using a computer for the sake of using a computer. There's no particular value in using a computer in a particular subject unless it helps you educate, get better in whatever it is you might be doing'. (ICT co-ordinator, private school, Cape Town, 1998).*

It was shown earlier in Section A that international experiences of ICT use in education do not provide sufficient evidence that ICTs improve teaching and learning. On the one hand there are those who argue that ICTs are in fact the most important and effective mechanisms available in the modern world for teaching and learning. On the other hand, others are more circumspect suggesting that the capacity of ICTs to add value to the educational experience is dependent not on ICTs in themselves, but rather on the context in which they are used and the kinds of learning processes they are used for.

While the context is obviously affected by factors influencing the education system broadly, one of the most important concerns about the context of ICT use is when computers take the place of teachers or are seen as more effective mechanisms for teaching. It is claimed that effective ICT use

requires a teaching and learning context characterised by high levels of innovation and commitment from educators who are willing to learn and develop insights as they move ahead. A teacher from a secondary school in Cape Town most aptly expresses these sentiments. In identifying the most crucial factor in 'getting it right' the teacher says:

> *'It's innovative staff, you've got to have innovative staff who are willing to do things in a different way and willing to learn along the way, and willing to turn round and say, well that did work, or that didn't work.'* [1]

The context in which ICTs are used influences the kinds of learning processes for which they are applied. A distinction is consistently made in the literature between drill and practice type learning and more critical evaluative learning. It is argued in Section A that ICTs can be effectively used to facilitate both forms of learning. Problems arise however when ICTs are used solely for repetitive learning and opportunities for critical evaluation are not grasped.

The domains of ICT use

The 'domains of use' refer to the areas in which ICTs are used at schools, i.e. in teaching and learning in classrooms, and in streamlining administrative and management functions. At least 30% of the schools that have computers listed administration and management as the most important use for computers in their school. At schools without computers, 37% indicated this area of use as their priority, when they acquire computers.

At the level of teaching and learning, the domain of ICT use can best be described by focusing on the learning areas in which teachers are presently using computers. Among the respondent schools, both primary and secondary, language and mathematics are the learning areas in which computers are most predominantly used. This focus is particularly evident in primary schools but together with a focus on technology, also dominates computer use in the secondary schools. In comparison, relatively few schools appear to be using computers in learning areas such as the Human Sciences, Arts and Culture, Life Orientation or even the Natural Sciences.

Differences in domains of ICT usage can also be seen from the kind of skills that form part of computer literacy training at schools. Basic computing principles and word processing tend to dominate the computer skills taught at most schools. At secondary level however, these skills combine with those that largely form part of the Computer Studies curriculum as the dominant focus areas.

The purposes for which ICTs are applied in teaching and learning

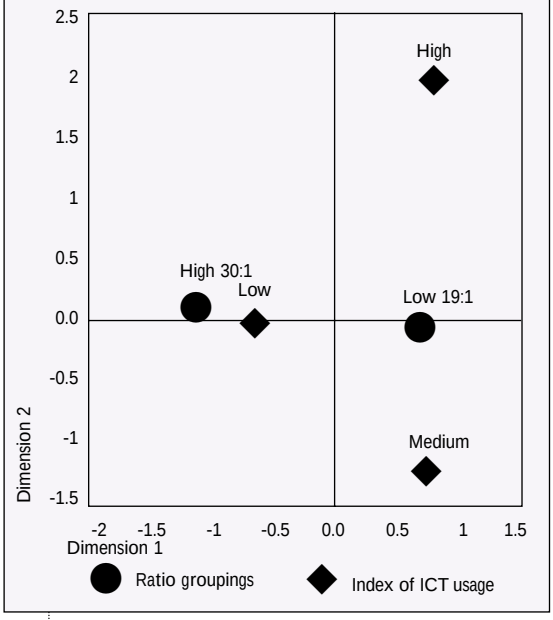
When schools were asked to indicate the purposes for which computers are used in their school, a picture emerged that showed a dominance of drill and practice type activities, particularly in the areas of language and mathematics.

The dominance of computers as a tool for repetitive learning processes is especially evident in primary schools where 55% of the primary schools in the sample identified drill and practice as the most important purpose for which computers were used (see Chapter 6). Other possible uses such as presentation of assignments, researching projects, simulation exercises and problem-solving activities all received relatively little support in comparison.

Although 32% of secondary schools that responded identified problem-solving as the most important purpose for which computers are used, drill and practice was still identified as most important by 22% of the schools. Thus overall,

1. Interview with secondary school teacher, Free State, April 1998

Table 11.1 Index of usage by average number of computers and printers[2]



80% of all the schools in the sample chose drill and practice as the most important use.

These findings reflect current usage. However, it is important to recognise that when schools were asked to prioritise the potential uses for computers in their school, a significant proportion of the schools stressed their use as a teaching and learning tool in all subjects. This purpose was also prioritised by a third of the respondents that did not have computers. It would seem therefore that while drill and practice type activities tend to dominate at present, there is an increasing awareness and wish on the part of schools to expand their computer use.

Software in use

The findings on the types of software used most in schools reinforces the picture already presented of the importance of ICTs in administration and management of schools, in basic computer skills development and in drill and practice type work. The survey shows how word processing and administrative software is used frequently in most schools with spreadsheets and programming languages also dominating the range of software at secondary schools. Presentation software and programmes that enable ICTs to be used as information resources (e.g. CD-Roms) are also used by a substantial number of schools.

While the survey data provides an indication of the scope and frequency of software used at schools, a number of respondents suggested that, even where computers are being used in specific learning areas, there is a tendency to rely on software that is orientated towards drill and practice activities as opposed to a more problem orientated approach. In discussing a popular mathematics programme used by a number of schools one ICT Co-ordinator at an independent school in Cape Town explained what he saw the limitations of this particular kind of software to be:

> *When you sit there, the computer asks you a question, you give an answer and the computer says right or wrong. This you can do with a textbook, quite frankly. The maths textbook will have the answer at the back, why pay thousands for software. And then it gives you final answers, and you get a multiple choice – that's the answer, there it is. Look, there's always scope for a kid by accident getting the right one right, but they might have done them incorrectly…There's no substance in that. Here is a different maths package, as an example, which is far more of a tutoring thing. It takes you through problems and in a basic way tries to identify where you're making a mistake and tries to help you in that way. We use that as a backup not as a substitute.'*

Modes of application

ICT use is very much affected by the manner in which learners engage with ICTs. In the questionnaire, schools were requested to indicate whether computers are primarily used for group work, individual work or both. The evidence from the survey indicates that across all the grades, a higher proportion of schools use computers for individual work with significantly less using it for group work or a

2. A brief explanation of how best to read the cluster analysis graphs appears in Chapter 10, page 136.

combination of individual and group work. As will be indicated in the next section, the mode of use is also strongly related to number of computers available in each school.

Critical issues in the 'effective' usage of ICTs

In 1996 it was noted by the Technology Enhanced Learning Initiative that, in general, initiatives using technology to support learning and teaching within the education system tended to focus on traditional pedagogic approaches with limited innovation (*TELI, 1996:13*). The survey findings presented here tend to support this claim. There is little evidence of what can be regarded as 'effective usage'. If we return to an earlier point, i.e. that 'effective' usage is directly related to the context of use as well as the kinds of uses to which ICTs are put, then it is important to focus more specifically on those factors that influence the context of ICTs in South African schools and thus define the manner in which they are used.

An *Index of ICT Usage* was constructed on the basis of the survey data.[3] According to this index, schools were grouped into three distinct categories of usage. On one end we find 'high usage' schools which demonstrate a relatively high degree of sophistication in the range and depth of uses to which their ICTs are put. At the other end of the scale there are those schools that, despite having access to ICT resources, display a much lower level of usage. In between these two extremes we can determine a medium level group displaying characteristics of both. By correlating this index with a number of other factors that might be related to ICT usage, we begin to get a more systematic and clearer picture of the characteristics of a 'typical' high usage school or a 'typical' low usage school.

Learner to teacher ratio

ICT usage is obviously related to the general levels of resources in a school. One indicator of such levels of resources (in the absence of more direct measures) is the ratio between learners and teachers. Using cluster analysis, the schools with computers were found to group into two categories: a high learner to teacher ratio group (30:1) and a low learner to teacher ratio group (19:1). Using multi-dimensional scaling techniques, the relationship between ICT usage and learner to teacher ratio groupings is presented in Figure 11.1.

Although the correlation between these two variables is rather weak (contingency coefficient = 0.128), it is highly significant and intuitively very plausible. High and medium levels of use cluster closer with low ratio groups; whereas low ICT use is clearly grouped together with the high ratio groups. Stated differently: the levels of use of ICTs (which includes the domains of software applications and number of learning areas covered) are clearly related to the size of classes, i.e. the learner to teacher ratio.

Start-up date

Using similar techniques, the *Index of ICT Usage* was correlated with the period during which schools indicated that they had started to use computers. The evidence (Figure 11.2) shows that schools that started using computers prior to 1990 are more likely to fall into the high usage category than those schools that started later. Similarly, among those schools that started to use computers after 1995 there is a greater propensity to fall into the low usage group (contingency coefficient = 0.118; Chi-square significant). This evidence suggests that the longer a school has had computers the more likely they are to make more use of their resources and display a greater degree of innovation and sophistication.

3. The first step in constructing the index of ICT usage was to add the total number of learning areas in which ICTs were being used and run K-means cluster analysis on these by school type. Schools clustered into two groups – those with a high number of learning areas and those with a low number of learning areas. The second step involved doing exactly the same procedure for software. Here frequency of usage of all thirteen types of software was summed and K-means cluster analysis was done by school type. The low group clustered around a mean of 11 (types of software used) and the high group clustered around a mean of 25. By combining the results of the first and second steps noted above, a fourfold classification with high face validity was produced. It showed high and low learning areas to be in opposite poles. It also showed high and low software usage to be in opposite poles. The cross-tabulated results were combined for the two levels of each variable to create a four level Index of ICT Usage.

Figure 11.2: Index of ICT usage by period in which schools started to use computers

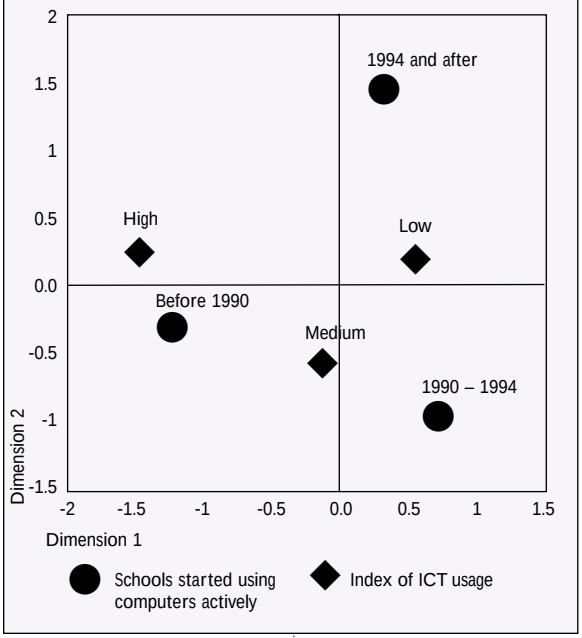
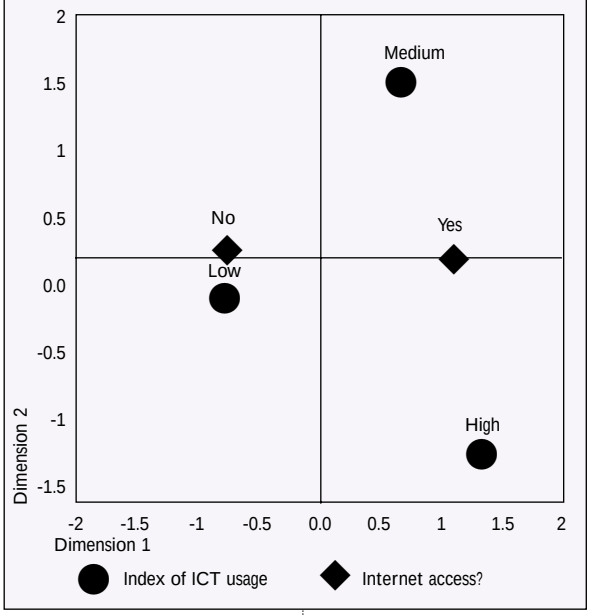


Figure 11.3: Index of ICT usage by Internet access



Use of ICTs in schools is influenced by the degree to which both learners and teachers develop a level of familiarity with the resources and in so doing contribute to the development of a culture of ICT use. Although this latter area will be discussed further in this chapter, a number of teachers interviewed in the study emphasised the 'trial and error' nature of ICT development and stressed that it is a slow process and '*not a quick thing*'. Obviously, the longer a school has had access to ICTs resources the more opportunities they have had to be creative and learn from experience. As discussed in Chapter 4, this observation is mirrored by the experiences of ICT development in schools in other countries.

The impact of ICT resource levels and usage

One of the most important factors that impacts on effective usage is the level of resources to which a school has access. A comparison of the average resources (computers and printers) for each of the three levels of the *Index of ICT Usage* reveals a clear correlation between usage and ICT resources (Figure 11.1). The correlation between the combined index of ICT resources (*ICT Sophistication Index* used in Chapter 10) and the *Index of ICT Usage* is moderate. Thus despite the importance of other factors in influencing ICT innovation, the evidence from the study shows that schools which are better equipped with regard to their ICT resources have a greater propensity and capacity to make more effective use of ICTs in the teaching and learning process.

If the average number (mean) of Pentiums in use is considered, the table shows that schools which fall into the high usage group have on average 23 Pentiums. On the other hand, those schools in the low usage category have on average 8 Pentiums with the medium group having 16 Pentiums. A trajectory of increasing resources and higher usage can also be seen with 486s and laser printers.

If access to the Internet and e-mail facilities are recognised as central to building an infrastructure around ICTs, then resource levels and usage are even more closely aligned. Figure 11.3 shows that there is a clear correlation between Internet access and use of ICTs. More specifically, the diagram shows that schools with high and medium levels of usage fall within the same half of the graph as those schools with Internet access. On the other hand no Internet access clusters closely to low usage.

This picture is further strengthened by Figure 11.4, which shows a clear correlation between those schools where more than 50% of the teachers have their own e-mail address and a high level of usage. On the other hand the graph shows an even stronger correlation between low usage and no teachers having their own e-mail addresses. A similar picture is evident with student e-mail facilities.

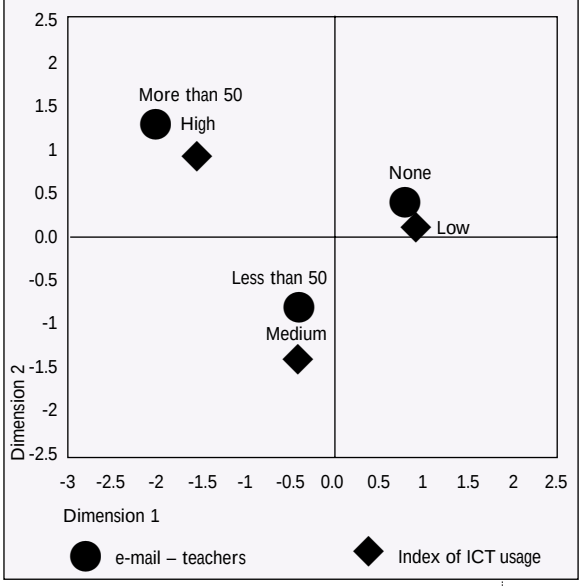
The use of e-mail and Internet facilities by teachers implies a minimum level of computer literacy among these educators. Thus, by recognising that high levels of usage can be correlated directly with the presence of educators who tend to make use of e-mail facilities, who have access to the Internet, and operate in a learning environment where they have been able to familiarise themselves with ICTs over a relatively long period of time, we can begin to isolate a number of key factors which appear to contribute to the development of an 'ICT culture' in schools.

Over and above, the factors already discussed high usage also correlates with greater after hours usage by learners and teachers and access by a greater percentage of learners to computer resources at home.

While other factors also need to be considered in influencing effective ICT usage, the pattern emerging suggests that having access to relatively high levels of resources substantially influences the nature and extent of ICT use. Having said this, it is interesting to note that when the usage and resource indexes were compared, the findings also showed that there were a greater percentage of high usage schools in the low resources category than there were low usage schools in the high resources category. Stated more simply, there are proportionately more higher resourced schools using their ICT resources less effectively than there are lower resourced schools doing the same.

This suggests that despite resource constraints some schools are able to overcome some of these barriers and move towards effective usage. It also shows however that there are schools that are relatively well resourced that are not using ICTs effectively. Although it is difficult from the findings of the study to postulate why this is the case, inferences from the data and the interview process point to the presence of one or more of the following factors in those schools which have low levels of resources but which show high levels of innovation.

Figure 11.4: Index of ICT usage by teacher e-mail facilities



- The presence of a 'champion' among the educators, parents or members of the surrounding community.
- A supportive network among educators in the same area.
- Strong support from the provincial education department.

These three factors are emphasised in Chapters 3 and 4 as central elements to successful ICT development.

Computer Studies as a school subject

As indicated in Chapter 6, schools were asked to indicate whether they taught Computer Studies as a subject at the school and whether they had a dedicated teacher employed to teach the subject. Given that Computer Studies is only taught at secondary school level, the results presented in Figure 11.5 are confined to these schools. The graph shows that among those schools with low levels of usage a greater number do not teach Computer Studies. On the other hand among the high and medium level users, a greater number indicate that they do teach Computer Studies and have a dedicated teacher for this purpose. This suggests that teaching the subject of Computer Studies in the school has contributed to the ICT culture mentioned earlier.

Figure 11.5 Index of ICT usage by the presence of Computer Studies as a subject

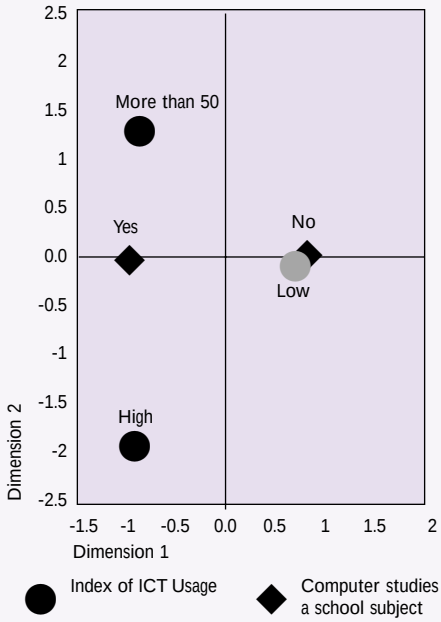
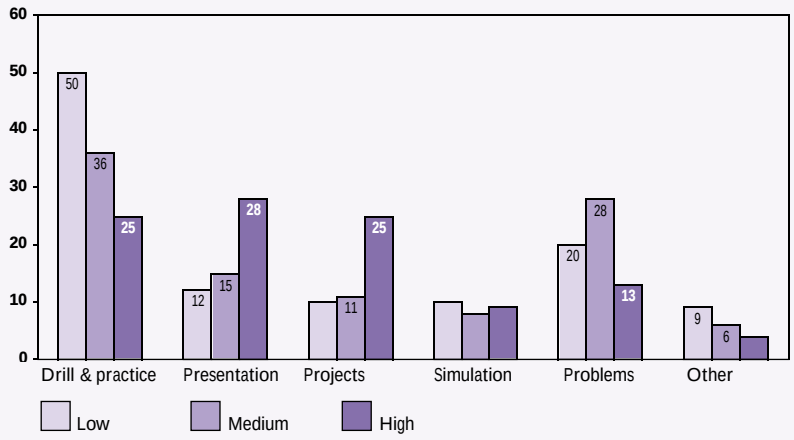


Figure 11.6: Index of ICT usage by computer users (First choice)



Moving beyond drill and practice

Figure 11.6 shows the comparison between the *ICT Usage Index* and the main purpose for which computers are used in schools. As can be expected, those schools that indicated that drill and practice was the most important purpose for which ICTs were used in their school fall mainly into the low usage group. On the other hand those schools that fall into the high usage category also show a preference for problem solving, project work and presentations. It is worth noting, however, that drill and practice still features prominently among this group of schools. This serves to emphasise the domination of this type of work within the use of ICTs in schools.

Conclusion

The findings and discussion presented in this chapter show that 'effective ICT usage' is a multi-dimensional construct. It is related to a range of software applications and scope of software integration, to different modes of application in the classroom and to differences in purposes of application. The number and sophistication of computer equipment and the general level of school resources (such as learner to teacher ratio's) have an impact on the effectiveness of ICTs. In the final analysis, only a small proportion of schools with computers (approximately 13%) have attained high levels of usage. This has far-reaching implications for policy, as we will discuss in Chapter 13.

12
ICTs and human resource capacity

In the previous chapter it was shown that certain critical factors contribute to the development of an 'ICT culture' in schools and that this culture is strongly related to effective use of ICTs. Drawing on the insights gained from international experience we argue that the notion of an ICT culture links to what has been called 'ICT capability'. More specifically, the international literature shows that effective use of ICTs takes place in contexts where a number of critical conditions have been met or where opportunities exist for these conditions to develop. Once these conditions are in place, schools appear to be able to move towards effective use of ICTs.

The key conditions are not unlike the conditions and concerns that confront education systems generally. In the South African context, as with many developing countries, it seems that the conditions necessary for the development of ICT capability revolve around access to basic resources and the presence of educators who have the skills, knowledge and confidence to engage creatively with ICTs in the process of teaching and learning. While these can be regarded as necessary conditions, the potential for them to become sufficient conditions for effective ICT use, revolves around how they are mobilised and applied.

In this chapter we provide an outline of what appear to be the central components of the human resources necessary for ICT capability. In doing so we evaluate the nature and extent of what exists currently and its impact on ICT practices and levels of provision in schools.

Educator attitudes towards ICT use

Beginning to use ICTs in education, like any process of fundamental change, involves a paradigm shift in educator thinking and practice. The attitudes towards the use of ICTs in teaching and learning, as well as perceptions of what the changes may mean for educators, are especially important to consider in developing the capacity of a school to use ICTs effectively.

The survey findings presented in Chapters 6 and 7 reveal the responses of teachers from schools that have computers and schools that don't. Respondents were asked to comment on:

- whether they see ICTs as beneficial for learners both in the learning process and in the post school environment.
- what the envisaged benefits may be.
- the potential of ICTs to assist them with their teaching.
- the concerns they may have about the use of ICTs in their school.

While the responses received from both the schools with computers and those without show an overwhelmingly positive response by educators towards the use of ICTs, a more detailed analysis shows that among the schools with computers, particular kinds of attitudes correlate with different levels of usage.[1] Responses received towards teacher attitudes

1. The Index of Usage used in this analysis is the same as that used in the previous chapter.

Figure 12.1: ICT usage and teacher attitudes to computers

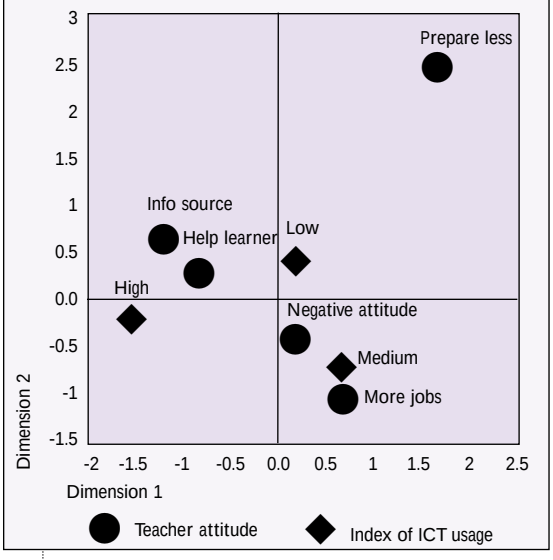
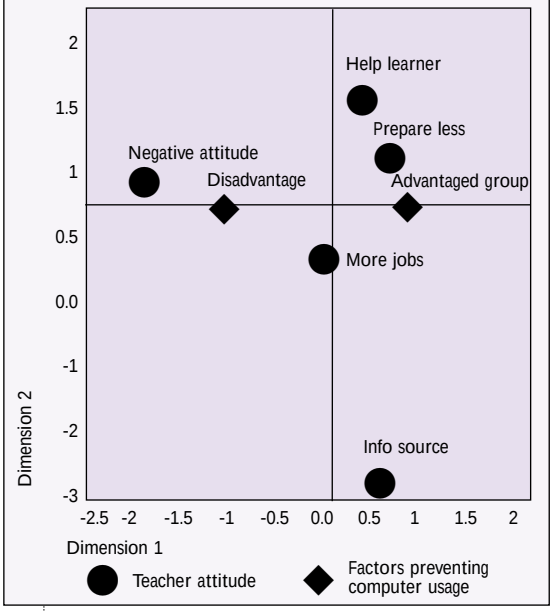


Figure 12.2 Teacher attitudes and factors preventing use of ICTs



were categorised into the following five groups:

- Positive attitudes towards computers as a source of information.
- Positive attitudes towards computers as tools to help learners think and work independently.
- Positive attitudes towards computers as tools to help teachers prepare lessons.
- Positive attitudes towards learners gaining skills that will give them greater job opportunities.
- Negative attitudes towards the use of computers.

When these categories were correlated with the *Index of ICT Usage*, the findings (see Figure 12.1) show that high level usage schools are clustered closer to positive teacher attitudes towards computers as sources of information and tools for independent work and thinking. Medium level usage schools correlated strongly with attitudes that saw the benefits of using computers to provide students with better job opportunities.

Of particular interest is the high correlation found between low levels of usage and negative attitudes towards computer use. From these findings it is clear that teacher attitudes are clearly related to the practices surrounding usage. One could even venture the following hypothesis: the greater the degree of sophistication in the use of ICTs the more positive the attitudes of teachers are towards computers.

Although it is difficult to categorically assert that positive attitudes are necessary among educators for ICT start-up and effective usage, both the findings of the survey and the international literature point towards a minimum level of confidence and awareness among teachers as a key factor necessary for both the start-up of ICT use and effective application. The evidence also seems to suggest that increased exposure to ICTs increases confidence and commitment from educators. Therefore positive attitudes appear to be both a pre-requisite for ICT development and a natural 'spin off' of ICT use.

The findings also show that where numerous barriers prevent the use of ICTs in a school (e.g. lack of funds, etc.) it is more likely that the teachers' attitudes towards ICT usage will be negative. In Figure 12.2 the negative attitudes category correlates most closely with the 'disadvantaged' group of schools (i.e. schools which have listed numerous factors preventing effective ICT usage). The advantaged group shows higher correlation with positive attitudes expressed by teachers.

While these findings seem to suggest that negative attitudes are linked to the presence of barriers to ICT development, it is important to recognise that in schools that have no computers, teachers are overwhelmingly in favour of ICTs and clearly recognise their potential benefits.

It seems that negative attitudes among teachers may operate as key barriers themselves or they may arise from the frustrations involved in overcoming the barriers to ICT development. Thus cultivating a positive attitude towards the use of ICTs in education is an important component of building capability for effective use.

This claim is reinforced when the attitudes of teachers are compared to the range of learning areas in which ICTs are used at a school. Schools where ICTs are used in a large range of learning areas cluster closer to teacher attitudes that emphasise independent thinking and learning. On the other hand, negative attitudes correlate strongly with those schools where few learning areas feature in ICT use. Other factors, such as access by teachers to e-mail, appear to follow a similar pattern to the one described above (i.e. where over 50% of teachers have access to e-mail there are positive attitudes, where there is no access, there are negative attitudes). This also suggests that exposure to ICTs has the effect of creating more positive attitudes towards their use.

Levels of skill and access to training

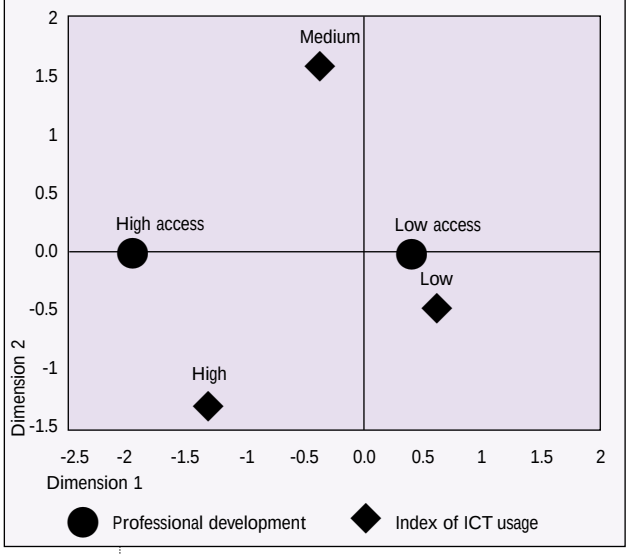
It is vital to note that positive attitudes to ICTs arise not only through exposure to the equipment but also through access to training. Correlating teacher attitudes with the degree of access that teachers have had to training in the use of ICTs reveals a significant relationship. Schools where teachers have had a relatively high level of access to training showed a correlation with positive attitudes towards helping learners think and work independently. As can be expected, negative attitudes correlated strongly with limited or low access to training opportunities.

> *'One problem at our school is that very few people know anything about computers. We depend on one teacher who doesn't have much time to assist children …if our teachers knew more about computers we could use them more efficiently. This is the fault of an education department that has done little to promote staff development … Teacher training is a major issue – none of our teachers are qualified to teach computer skills' (Principal of a state school, 1998).*

In the review of international experience of ICTs in education (Chapter 4) it was shown that educator development is one of the most critical factors in building and sustaining ICT capability in schools. International experience also shows that when teachers are inadequately trained they lack the confidence to move beyond drill and practice work to more problem orientated approaches. Education policy from developed countries such as the USA and the UK strongly emphasises the importance of training in the area of ICTs. Furthermore, strategies for teacher training in the use of ICTs form a key component of these education policies and a substantial amount of funding is allocated for it.

The fact that educator development is so important in ICT development tends to put developing countries at a disadvantage because lower levels of skill exist among educators generally. This is very apparent in South Africa where, as described in Chapter 5, the historical legacy of inadequate, inappropriate and unequal provision of training for educators has resulted in a situation where many teachers are under-qualified for the tasks they have to perform.

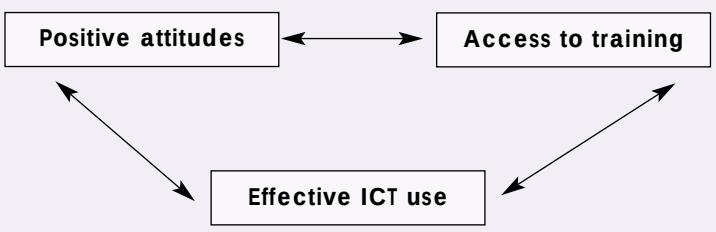
Figure 12.3 Access to training and ICT usage



While the Minister of Education has prioritised the development of the 'professional quality of our teaching force' in the immediate future, the low levels of skills continue to impact negatively on ICT use in schools. Not only is lack of educator skills a key barrier to equity in ICT provision, but it also impacts significantly on how effectively ICTs are acquired and applied.

The data presented in Chapter 6 shows clearly that while some teachers have had opportunities for training, access to such opportunities are extremely limited. The concerns that arise from this are deepened when access to training is correlated to ICT start-up and use. The survey findings indicate clearly that extensive access to training in ICTs is significantly correlated with more effective use and more positive attitudes among teachers. It seems therefore that the three areas of; positive teacher attitudes, access to training and effective ICT use all operate together in generating ICT capability. This can be illustrated in the following way:

Figure 12.4: Factors shaping ICT capability



Access to training is obviously related to resources and the more privileged schools have had more opportunities for teacher training. Similarly, the longer schools have had access to ICTs the more opportunities appear to have been taken for training in this area.

To develop a deeper understanding of this, the *Index of Professional Development* was developed. From the responses given by schools about the training their teachers had received, two categories were developed. The high ccess category signifies an average access to more than four of the training opportunities listed (this applies to approximately 17% of schools). The low access category implies that teachers had access on average to slightly more than one and a half training opportunities (this applies to the remaining 83% of schools). This *Index of Professional Development* was then correlated with several other factors as described below.

Figure 12.3 shows the relationship between professional development and the *Index of ICT Usage*. As noted earlier access to training correlates strongly with resource levels.

In Figure 12.5 the *Index of Professional Development* is correlated with the *ICT Sophistication Index* (level of ICT resourcing). The graph shows clearly that there is a strong correlation between access to training and high levels of resources while low access to training clusters closer to low resource levels.

A similar picture is evident when access by teachers to e-mail facilities was correlated to professional development. That is, high access to training correlates closely with access to e-mail facilities (especially where more than 50% of the teachers have access to such facilities) and low access with schools where teachers have no access to e-mail facilities. The patterns presented here suggest that access to training in ICTs for teachers is an equity issue and that it affects how well ICTs are used in schools.

In terms of equity, both schools with computers and those without identify the lack

of teacher training around ICTs as a critical constraint to the start-up and expansion of ICTs. Among schools with no computers, 56% said lack of available staff prevents them from acquiring ICTs. Similarly, when requested to identify conditions and resources that they feel must be in place before the school can start using computers, 71% cited the need for a teacher with adequate training to facilitate the use of ICTs.

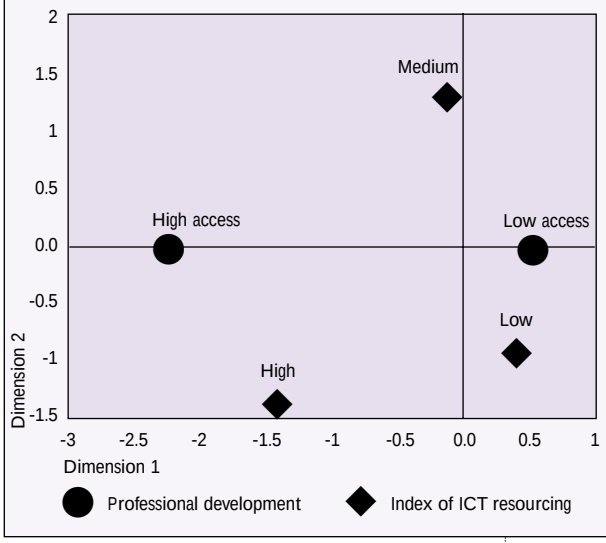
Among schools that do have computers, the majority of respondents prioritised lack of adequately trained staff when asked about what the factors were that prevent maximum use of their computers. Thus it seems that despite the presence of a comparatively good resource base, the lack of skills among educators to use computers effectively remains a key concern.

Quality of existing training

As indicated by the high professional development cluster, some schools have had access to professional training around ICTs. Opinions differ on the effectiveness of the training. The survey data indicates that where teachers have had access to ICT training provided by their provincial departments (this is particularly evident among schools in the Western Cape) the training has been well received and appropriately targeted. On the other hand some respondents complain that much of the training that is available, particularly by private organisations, takes place 'in a vacuum' and has little relevance to the education terrain. One provincial advisor on ICTs had this to say regarding the type of training available to teachers:

'Let me tell you quite a lot of teachers have been to such courses. Well what I discovered is that those people are just giving those courses for the sake of getting money. Teachers come out there not knowing a thing about the computer in a school situation because they are training various types of people for various organisations. They don't look at – say what a teacher is and how can they use this equipment in their situations? That thing has not been addressed. That is what the department is now trying to do. In a school situation, how can this machinery assist you with this and that.'

Figure 12.5: Index of professional development by Index of ICT Sophistication (ICT resourcing)



Lack of clear curriculum guidelines

Other stakeholders argue that low levels of teacher skill and capacity is exacerbated by a lack of 'guidelines' or appropriate 'curriculum' for the teaching of computer skills and most importantly with integrating computers into the teaching and learning process. The following concerns expressed by teachers point to this problem:[2]

'It is imperative that computers be taught within an integrated fashion and that set guidelines be provided. This will go a long way in allowing learners to appreciate computers as a tool. Although we use the resource extensively to improve student skills we don't really know what to emphasise';

'It would help a lot if we got help from somewhere as we have a computer, but have difficulty operating it… Some computers are used for non-educational purposes because we don't know what to teach children…'

2. Interviews with teachers, Northern Province, Free State and Western Cape, 1998.

Table 12.1: Ratio of male to female ICT educators in South African schools

Type of school	National ratio, male to female	Teaching of computer skills, ratio of male to female teachers	Teaching of Computer Studies, ratio of male to female teachers
Primary	1:2.8	1:2.2	
Secondary	1:1.8	1:1.1	1:1.3

'The lack of guidance from provincial education departments limits initiative and acceptance by both teachers and parents.'

'We need clarity on the Department of Education's position on computer issues. The absence of clear guidelines makes it extremely difficult to plan and to know whether we are teaching learners appropriate computer skills.'

While these concerns were more prevalent among the respondents it is also heartening to note the progress made by some schools in developing their own models for ICT integration.

'What we are involved with is what we call IT integration, where we work with subject teachers to see how they can involve IT in a constructive manner in subjects. It's always got to be driven by education, not by IT.'

'We are very happy. We developed the syllabus ourselves. There is no set syllabus anywhere. I phoned and phoned and phoned about a year and a half to two years ago to say 'where is a computer literacy syllabus, what do we teach them, how do we teach them?' And I got 'You're on your own.' We have developed our own syllabus. We have our own programme and we're quite happy with it at the moment. We're very pleased with our efforts, with what we've done.'

While the picture presented above shows a real need for teacher training and effective ICT use, schools themselves do not generally indicate that teacher training will be a significant priority for their budgets over the next few years. There are a number of reasons why teacher training may not be seen as a priority budget item. These may include, among other reasons: that this item cannot be prioritised above other more pressing needs; educator development is too costly for the school, or that, as has been the situation historically, in-service teacher training is provided for through the departments of education and may be regarded by schools as being clearly the Departments' responsibility.

The lack of clarity on this means that South Africa falls short of necessary conditions for ICT development if international precedent in developed countries is taken into consideration. As pointed out in Chapter 3, both the UK and USA argue that the most important component of their ICT budget is dedicated to educator development – both in-service and pre-service. Moreover, recent initiatives have tended to increase funding for training rather than decrease it. As in many other developing countries, the lack of educator development in this area remains a key weakness in building an ICT capability in schools.

Although the information collected through the survey refers primarily to in-service training for teachers, a limited investigation into existing provision for ICT development among teachers at higher education institutions showed limited pre-service training opportunities as well. Having said this, however, some institutions do have a number of exciting initiatives in the early stages of development that have the capacity to improve skills at the pre-service level.

Gender and ICT educators

Although the survey was only able to provide limited information regarding the gender profile of educators involved in ICT use, respondents were asked to indicate the gender

of the person who taught computer skills at the school and, in secondary schools in particular, the gender of the person responsible for the teaching of Computer Studies was asked. Although a first reading of the data shows that there are more women teachers currently teaching in both these areas, when the ratios are compared to the national average a slightly different picture emerges. Table 12.1 summarises the ratio of male to female teachers in the two areas as well as the national average for both primary and secondary schools.

The table shows clearly that the ratio of males to females is slightly higher in this area compared to the national average of men to women educators. This suggests that, as in the rest of the world, there is a high proportion of male teachers in this area. So, while there are significantly more women educators in this country, certain subject areas, and most management positions, are dominated by men.

Conclusion

Effective use of ICTs is tied to a number of 'softer' issues namely: positive attitudes towards computers and their use, sufficient knowledge and skills acquired through sustained professional development and, perhaps most importantly, an appreciation of the intrinsic value of ICTs. The latter point, we believe, is a crucial finding of the study: teachers who appreciate that ICTs are valuable in themselves, as vehicles of learner empowerment, independent thinking and sources of strategic information, tend to use ICTs more effectively. In other words they use a larger range of software applications and show a more integrated approach to learning areas. ICTs are seen, not only as a means for learners to pursue career options or primarily as tools to facilitate lesson preparation, but also as essential to learner development.

A

Questionnaire A

National Survey on Computers in Education in South African Schools

Questionnaire A
Schools that have one or more computers

Sponsored by the
International Development Research Centre (IDRC)

Instructions

1. Only complete this questionnaire if t**he school has at least one or more computers** used for administration purposes and/or for teaching and learning.

2. Please answer all the questions as fully as possible.

3. Where the particular question is not applicable to the school, please mark ‘N/A’ (not applicable) and proceed to the next question.

4. Please note that the following abbreviations have been used throughout the questionnaire:

   G = Grade
   NGO = Non-governmental organisation

5. Enclosed with your questionnaire is a **self-addressed envelope** for the returned questionnaire. This envelope requires **no additional postage costs** and can be sent to the EPU from any postage point.

6. Please return the questionnaire to the EPU by the **23 November 1998** to enable the researchers to process the information as quickly as possible.

Education Policy Unit
University of the Western Cape
Private Bag X17
Bellville 7535

Name of School:

.....

.....

☐ (1)

Physical address

Number and street: ..... ☐ (2)

Suburb/area: ..... ☐ (3)

Town/City: ..... ☐ (4)

Postal code: ..... ☐ (5)

Fax. Number (if applicable): ..... ☐ (6)

Email address (if applicable); ..... ☐ (7)

Website address (if applicable): ..... ☐ (8)

Section A : Audit of Resources

For Office Use

A1 Tick which of the following technology items the school has available for teaching and learning purposes.

1	TV(s)	☐
2	Computer(s)	☐
3	Video Machine(s)	☐
4	Electric Radio(s)	☐
5	Wind-up Radio(s)	☐
6	Overhead Projector(s)	☐
7	Slide & Tape Projectors(s)	☐
8	Projector(s) linked to a computer	☐
9	Tape recorder(s)/CD player(s)	☐
10	Other. Specify _____	☐☐ (9-19)

A2 In the table below please indicate the number of computers that the school presently has.

	Older than 486	486 type	Pentium type	
Number in Use				☐☐☐
Number not in Use				☐☐☐ (20-25)

A3 How many of the above computers have a CD-ROM drive?

☐ (26)

A4 What operating system do the computers <u>in use</u> have?

	Dos	Windows 3.1	Windows 95/98	
Number				☐☐☐ (27-29)

A5 Does the school have access to the Internet?

☐ Yes ☐ No ☐ (30)

A6 How does the school mainly gain access to the Internet?

- ☐ Dial-up modem (14.4 to 56k)
- ☐ Integrated services digital network (ISDN)
- ☐ Leased line
- ☐ Other. Specify _____

☐☐ (31-32)

A7 Which is the main Internet Service Provider (ISP) for the school (e.g. Western Cape Schools Network (WCSN))?

.....

.....

☐ (33)

A8 What is the approximate cost per month for the school to access the Internet?

Telkom or cellular provider costs: R _____
Internet Service Provider (ISP) costs: R _____

☐☐ (34-35)

A9 Does the school have a computer network?

☐ Yes ☐ No

☐ (36)

A10 If yes, how many computers are linked to the network?

.....

☐ (37)

A11 Does the school have a file server?

☐ Yes ☐ No

☐ (38)

A12 What type(s) of printer(s) are available at the school?

	Type of Printer	Number
Laser		
Ink/Bubble Jet		
Dot Matrix		

☐☐
☐☐
☐☐ (39-44)

A13 In the table below indicate the software that the school uses and the frequency of use.

Type of Software	Availability (Yes/No)	Frequency of Use		
		Not at all	Infrequently	Frequently
Problem-Solving/ Creativity (Treasure Maths Storm)				
Drill and Practice (Number Munchers)				
Word Processing (Student Writing Centre, MS Word etc.)				
Spread Sheets (The Cruncher, Excel etc)				
Presentation Software (Print Shop, PowerPoint)				
Drawing Software (Kid CAD, Corel Draw)				
Internet Browsers (Netscape, Explorer)				
Programming Languages (Logo, Pascal, C++)				
School Administration/ Finance				
Simulation Software (ADAM, SimCity, etc.)				
Database (MS Access)				
Web Publishing (FrontPage)				
Information Resources (CD-ROM encyclopaedias)				

☐☐ (45-70)

A14 Estimate the proportion of the following groups who have their own personal e-mail address?

Groups	None	1-25%	26-50%	51-75%	Over 75%
Management (e.g. Principal, Deputy Principal, HOD)					
Administration (e.g. Secretary)					
Teachers					
Learners					

☐ (71-74)

A15 Estimate the proportion of the learners at the school that have access to a computer at home?

For Office Use

	G1-G3	G4-G7	G8-G10	G11-G12
None				
1-25%				
26-50%				
51-75%				
Over 75%				

☐☐☐☐ (75-78)

For Office Use

B1 Tick which of the following computer skills are taught to the learners at the school.

Computer Skills	G1-G3	G4-G7	G8-G10	G11-G12	
1 Basic Principles of computers					☐☐☐☐
2 Word processing					☐☐☐☐
3 Spreadsheets					☐☐☐☐
4 Presentation graphics					☐☐☐☐
5 File management					☐☐☐☐
6 Using the Internet (e-mail, world-wide web)					☐☐☐☐
7 Database					☐☐☐☐
8 Information Skills (research on CD-ROMS, Internet)					☐☐☐☐
9 Desktop Publishing					☐☐☐☐
10 Web design					☐☐☐☐
11 Programming skills					☐☐☐☐
12 Systems analysis and design					☐☐☐☐
13 Ethics (acceptable use, plagiarism, hacking)					☐☐☐☐
14 Other. Specify					☐☐☐☐ (79-138)

B2 For G8-G12 indicate, in order of priority, the three most important skills. *(Indicate the choices by using the numbers from the list above.)*

Choice 1: ☐

Choice 2: ☐

Choice 3: ☐ (139-141)

B3 Indicate the proportion of <u>male</u> learners at the school that are taught computer skills.

Proportion of Learners	G1-G3	G4-G7	G8-G10	G11-G12
None				
1-25%				
26-50%				
51-75%				
Over 75%				

☐☐☐☐ (142-145)

B4 Indicate the proportion of <u>female</u> learners at the school that are taught computer skills.

Proportion of Learners	G1-G3	G4-G7	G8-G10	G11-G12
None				
1-25%				
26-50%				
51-75%				
Over 75%				

☐☐☐☐ (146-149)

B5 How many hours per week do learners spend learning computer skills?

Hours of Learning	G1-G3	G4-G7	G8-G10	G11-G12
0-1 hour				
2-3 hours				
4-5 hours				
6-7 hours				
more than 7 hours				

☐☐☐☐ (150-153)

B6 Who <u>mainly</u> teaches computer skills at the school?

- ☐ A permanent member of the teaching staff in a full post for this purpose
- ☐ A contract teacher employed by the school governing body for this purpose
- ☐ A full-time person working for a commercial provider
- ☐ A permanent member of the teaching staff who teaches computer skills in addition to another full-time responsibility
- ☐ More than one permanent teaching staff member on a part-time basis
- ☐ Other. Specify _____

☐☐ (154-155)

B7 **Indicate the gender of the person who mainly teaches computer skills.**

For Office Use

☐ Male ☐ Female ☐ (156)

B8 **Tick <u>one item</u> that should be emphasised to extend the teaching of computer skills at your school.**

☐ Offering teaching in a greater range of computer skills

☐ Improving the depth of knowledge around the computer skills already taught

☐ Increasing the time available for learners and teachers to learn computer skills

☐ Other. Specify _____ ☐☐ (157-158)

For Office Use

C1 Tick the learning areas in which computers are used in teaching and learning.

- [1] Language Literacy and Communication (e.g. English)
- [2] Mathematical Literacy and Mathematical Sciences (e.g. Mathematics)
- [3] Natural Sciences (e.g. Biology)
- [4] Technology (e.g. Computer Studies)
- [5] Human and Social Sciences (e.g. History)
- [6] Economics and Management Sciences (e.g. Business Economics)
- [7] Arts and Culture (e.g. Music)
- [8] Life Orientation (e.g. Life Skills)
- [9] Other. Specify _____

(159-168)

C2 Indicate in order of priority two learning areas where learners make the most use of computers. *(Indicate the choices by using the numbers from the list above.)*

Choice 1: _____

Choice 2: _____

(169-170)

C3 For Choice 1 above, indicate the purposes for which computers are used, if at all, in the different grade groups.

Purpose of Computer use	G1-G3	G4-G7	G8-G10	G11-G12
[1] Drill and Practice				
[2] Presentation of Assignments				
[3] Researching Projects				
[4] Simulation Exercises				
[5] Problem Solving				
[6] Other. Specify				

(171-198)

C4 Indicate in order of priority the two most important purposes for which computers are used in this learning area. *(Indicate the choices by using the numbers from the list above.)*

Choice 1: _____

Choice 2: _____

(199-200)

C5 **Tick the <u>one</u> item that best describes <u>the way in which computers are used</u> by learners in the relevant grade.**

Computer use by learners	G1-G3	G4-G7	G8-G10	G11-G12
For individual work				
For group/collaborative work				
For both				
Other. Specify				

☐☐☐☐
☐☐☐☐ (201-208)

C6 **Tick the <u>factors</u> that prevent the school from using computers as a teaching and learning tool.**

1 Lack of a dedicated computer teacher ☐
2 Lack of computer literacy among subject teachers ☐
3 Lack of subject teachers with training on how to integrate into specific learning areas ☐
4 Insufficient number of computers ☐
5 Lack of suitable space in school for computers ☐
6 Absence of a properly developed curriculum for teaching computer skills ☐
7 Fear by teachers that computer use may take over from the teaching role ☐
8 Insufficient funds ☐
9 Other. Specify _____ ☐☐ (209-218)

C7 **Indicate in order of priority the three main factors that prevent the school from using computers as a teaching tool.** *Indicate the choices by using the numbers from the list above.)*

Choice 1: ☐
Choice 2: ☐
Choice 3: ☐ (219-221)

For Office Use

D1 Does the school offer a subject that focuses on computer studies?

☐ Yes ☐ No ☐ (222)

If yes, please complete the rest of Section D. If no, please proceed directly to the questions in Section E.

D2 Tick for which grades this is offered

1 Below G8 ☐

2 G8-G11 ☐

3 G11-G12 ☐ (223-225)

D3 Tick the areas of work covered in the subject for the grades indicated below.

Areas of Work Covered	G8-G10	G11-G12	
Introduction to computers			☐☐
The basics of programming			☐☐
Programming languages (C++, Pascal)			☐☐
Using spreadsheets and databases			☐☐
Authoring packages			☐☐
Systems analysis and design			☐☐
Other. Specify			☐☐☐☐ (226-241)

D4 Does the school have a specific teacher responsible for teaching computer studies?

☐ Yes ☐ No ☐ (242)

D5 If <u>yes</u>, please indicate the gender of the person who teaches computer studies.

☐ Male ☐ Female ☐ (243)

D6 **Tick the reasons why the school believes that computer studies is important.**

For Office Use

- ☐ Will provide the students with skills that are necessary for the country's economic development ☐
- ☐ Makes the school more attractive compared to other schools ☐
- ☐ Provides a career option for the learners ☐
- ☐ Provides skills that learners will be able to use in any of their career options ☐
- ☐ Other. Specify _____ ☐☐ (244-249)

For Office Use

E1 Does the school have a specific budget for computers?

☐ Yes ☐ No ☐ (250)

E2 If yes, tick the items the computer budget of the school has been spent on for the last two years?

1 Purchase of new computers ☐
2 Upgrading of existing computers (e.g. addition of CD-ROM drives to 486 machines) ☐
3 Purchasing of new software ☐
4 Teacher training to use computers for teaching and learning ☐
5 Maintenance of computers ☐
6 Purchasing the necessary hardware and software to get the school connected to the Internet/e-mail ☐
7 Other. Specify _____ ☐☐ (251-258)

E3 Indicate, in order of priority, the two items that received the most funding. *(Indicate the choices by using the numbers from the list above.)*

Choice 1: ☐

Choice 2: ☐ (259-260)

E4 Tick the source(s) of funding responsible for new computer resources at the school.

1 Donation from parents ☐
2 Provincial Government allocation ☐
3 Private Sector (eg. Business & National and International Donor Agencies) ☐
4 NGOs ☐
5 Allocation from school fees ☐
6 Computer levy ☐
7 School fund raising activities ☐
8 Other. Specify _____ ☐☐ (261-269)

E5 **Indicate in order of priority, two most important sources of funding and state whether the contribution was a financial donation or a donation of equipment (e.g. computers, modems, software)** *(Indicate the choices by using the numbers from the list above.)*

Source	Financial Donation	Equipment
Choice 1:		
Choice 2:		

☐☐
☐☐ (270-273)

E6 **Tick the sources of financing for <u>supporting the maintenance</u> and use of computers at the school**

1 ☐ Donation from parents ☐
2 ☐ Provincial Government allocation ☐
3 ☐ Private Sector (eg. Business & National and International Donor Agencies) ☐
4 ☐ NGOs ☐
5 ☐ Allocation from school fees ☐
6 ☐ Computer levy ☐
7 ☐ School fund raising activities ☐
8 ☐ Other. Specify _____ ☐☐ (274-282)

E7 **Indicate in order of priority the two most important sources of funding.** *(Indicate the choices by using the numbers from the list above.)*

Choice 1: .....

Choice 2: ..... ☐☐ (283-284)

E8 **Tick the person/group who mainly provides the <u>maintenance and technical support</u> for the school's computers.**

1 ☐ Principal ☐
2 ☐ Responsible teacher(s) ☐
3 ☐ Private professionals/ commercial providers ☐
4 ☐ Learners ☐
5 ☐ Parents ☐
6 ☐ No specific person or group ☐
7 ☐ Other. Specify _____ ☐☐ (285-292)

E9 **Tick the person/group who is <u>mainly responsible for managing</u> the computers in the school. (For example, the person who undertakes tasks like planning, budgeting, acquiring equipment and software)**

For Office Use

1	Principal	☐
2	Responsible teachers(s)	☐
3	Private professionals/ commercial providers	☐
4	Learners	☐
5	Parents	☐
6	No specific person or group	☐
7	Other. Specify _____	☐☐ (293-300)

For Office Use

F1 Tick which of the following statements best describe the way most teachers at the school feel about the use of computers in education.

1	Teachers feel computer skills will provide learners with greater job opportunities	☐
2	Teachers feel that there is little value in using computers for learning	☐
3	Teachers feel that other needs should be given greater priority in the school	☐
4	Teachers strongly support the use of computers in education as they see computers as important in helping learners to think and work independently.	☐
5	Teachers are concerned that any new technology will increase the work level of teachers	☐
6	Teachers are worried that computers will require them to do further training	☐
7	Teachers feel that computers can be of use in preparing lessons and administrative tasks	☐
8	Teachers see computers as an important source of information to access resources not available to them in the school	☐
9	Teachers believe that computers can be used to allow learners and teachers to interact with other schools through e-mail or joint projects.	☐
10	Other. Specify _____	☐☐ (301-311)

F2 Indicate in order of priority the three most common feelings that teachers have about the introduction of computers in education.
(Indicate the choices by using the numbers from the list above.)

Choice 1: ☐

Choice 2: ☐

Choice 3: ☐ (312-314)

F3 When did the school first begin to actively use computers?

1	Before 1976	2	1977-1980
3	1981-1984	4	1985-1989
5	1990-1994	6	After 1995

☐ (315)

F4 Tick the reason(s) why the school began to use computers.

- [1] To prepare students for the future
- [2] To attract students to the school
- [3] To improve student learning
- [4] To keep the curriculum and methods up-to-date
- [5] To facilitate new forms of learning
- [6] To offer the surrounding community access to computers for adult learning
- [7] Other. Specify_____

(316-323)

F5 Tick the items below that the school believes should be prioritised regarding computer utilisation at the school.

- [1] Use of computers in school management and administration
- [2] Computer use for staff professional development
- [3] Computer use for lesson preparation
- [4] Use of computers as a teaching and learning tool in all subjects
- [5] To teach computer skills
- [6] To expose students to the potential benefits of computers in every day life
- [7] Other. Specify _____

(324-331)

F6 Indicate in order of priority, the two most important uses of computers for the school. (*Indicate the choices by using the numbers from the list above.)*

Choice 1: .....

Choice 2: .....

(332-333)

F7 What percentage of the following groups are regular computer users at the school?

	None	1-25%	26-50%	51-75%	Over 75%
Management (e.g. Principal, Deputy, HOD)					
Administration (e.g. Secretary)					
Teachers					
Learners					

(334-337)

F8 **Tick the items below that the school is likely to spend money on over the <u>next two years</u>.**

For Office Use

1 Purchase of classroom equipment (eg. Overhead projectors, black boards) ☐

2 Alterations to school building (eg. building maintenance, more classrooms, toilets, repairs to windows) ☐

3 Purchase of teaching resources (eg.text books) ☐

4 Purchase of new stationery (eg. pens, pencils, writing books) ☐

5 Upgrading of existing computer resources (eg. Purchasing modems or buying more memory) ☐

6 Purchase of new computers ☐

7 Teacher Training ☐

8 Other. Specify _____ ☐☐ (338-346)

F9 **Indicate in order of priority the three most important items the school is likely to spend money on over the next two years.**
(Indicate the choices by using the numbers from the list above.)

Choice 1: ☐

Choice 2: ☐

Choice 3: ☐ (347-349)

F10 **Tick the type(s) of technology-related professional development teachers at the school have had access to.**

1 No teacher at the school has had access to professional development in computers ☐

2 Courses or workshops on basic introduction to hardware / word processor applications ☐

3 Courses offered by a university or technikon ☐

4 Courses offered by private training organisations (e.g. Damelin, Microsoft) ☐

5 On-site visits to other schools where computers are being used ☐

6 On-line distance learning professional development courses ☐

7 One-to-one professional mentoring at schools (e.g. Computers4Kids, FutureKids) ☐

8 Collaborative training opportunities under the guidance of a technology proficient instructor ☐

9 Courses and workshops offered by an education department (e.g. a teachers' centre) ☐

10 Other. Specify _____ ☐☐ (350-360)

For Office Use

F11 Indicate in order of priority <u>the two</u> most useful types of professional development training the teachers at the school have had access to. *(Indicate the choices by using the numbers from the list above.)*

Choice 1: ☐

Choice 2: ☐ (361-362)

F12 Tick the type(s) in-service computer related training that the school believes teachers need.

1	Basic introduction to computers	☐
2	Introduction to applications like word processing, database and spreadsheets	☐
3	Training in how to incorporate computers into the learning process	☐
4	Using computers for the administrative functions of their work	☐
5	Using computers for information acquisition for their subjects	☐
6	Using computers for communication between teachers	☐
7	Other. Specify _____	☐☐ (363-370)

F13 Indicate in order of priority, the two most important types of computer related training that the school believes teachers need. *(Indicate the choices by using the numbers from the list above.)*

Choice 1: ☐

Choice 2: ☐ (371-372)

F14 What conditions prevent the school from maximising the use of computers.

1	Limited classrooms that are suitable for computers	☐
2	Poor ventilation and lighting of rooms for computer use	☐
3	No electricity	☐
4	Power failures due to poor electricity supply	☐
5	No phone line	☐
6	Vandalism of equipment and facilities	☐
7	Poor security on school premises	☐
8	Obsolete computer equipment, which cannot be used for classroom instruction or educational purposes	☐
9	Lack of available staff trained to use computer equipment and software	☐
10	Other. Specify _____	☐☐ (373-383)

F15 Indicate in order of priority the three most important factors that hinder the continued use of computer facilities at the school. *(Indicate the choices by using the numbers from the list above.)*

Choice 1: ☐

Choice 2: ☐

Choice 3: ☐ (384-386)

F16 If the school has Internet access, what are the limiting factors to more effective use?

1 Security and facilities ☐

2 Costs for Internet access ☐

3 Computers that do not have the capacity and facilities for Internet access ☐

4 Concern from parents and teachers that learners will use the Internet inappropriately (e.g. playing games, accessing inappropriate material). ☐

5 Absence of telephone connections in classrooms ☐

6 Other. Specify _____ ☐☐ (387-393)

F17 Indicate in order of priority the two most important factors that limit Internet access at the school. *(Indicate the choices by using the numbers from the list above.)*

Choice 1: ☐

Choice 2: ☐ (394-395)

For Office Use

G1 Do students use the school's computers after school hours?

☐ Yes ☐ No ☐ (396)

G2 If yes, indicate the proportion of <u>male</u> learners that use the computers after school hours.

Proportion of Learners	G1-G3	G4-G7	G8-G10	G11-G12
1-25%				
26-50%				
51-75%				
Over 75%				

☐☐☐☐ (397-400)

G3 If yes, indicate the proportion of <u>female</u> learners that use the computers after school hours.

Proportion of Learners	G1-G3	G4-G7	G8-G10	G11-G12
1-25%				
26-50%				
51-75%				
Over 75%				

☐☐☐☐ (401-404)

G4 Tick the <u>one group</u> that makes the most use of the school's computers after hours.

☐ Parents
☐ Other schools
☐ Students
☐ Teachers
☐ Local businesses
☐ Members of the community
☐ Other. Specify _____

☐☐ (405-406)

G5 **Tick the <u>most important reason</u> why outside groups make use of the school's computers.**

For Office Use

- ☐ To attend regular computer classes run by the school during school hours
- ☐ To attend computer courses/classes run by the school after school hours
- ☐ To attend computer courses conducted by outside organisations and groups
- ☐ For outside groups to access computers for e-mail and Internet use
- ☐ Other. Specify _____

☐☐ (407-408)

G6 **Does the school charge a fee for the use of the computers by outside groups?**

☐ Yes ☐ No

☐ (409)

G7 **Indicate below any aspect of computers in education that you feel has not been covered in the questionnaire and/or the school belives should be elaborated upon.**

☐ (410)

Thank you very much for your assistance.

B

Questionnaire B

National Survey on Computers in Education in South African Schools

Questionnaire B
Schools that have no computers

Sponsored by the
International Development Research Centre (IDRC)

Instructions

1. Only complete this questionnaire if the school has **no computers** used for administration purposes and/or for teaching and learning.

2. Please answer all the questions as fully as possible.

3. Where the particular question is not applicable to the school, please mark 'N/A' (not applicable) and proceed to the next question.

4. Please note that the following abbreviations have been used throughout the questionnaire:

   G = Grade
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6. Please return the questionnaire to the EPU by the **23 November 1998** to enable the researchers to process the information as quickly as possible.

Education Policy Unit
University of the Western Cape
Private Bag X17
Bellville 7535

Name of School:

.....

..... ☐ (1)

Physical address

Number and street: ..... ☐ (2)

Suburb/area: ..... ☐ (3)

Town/City: ..... ☐ (4)

Postal code: ..... ☐ (5)

Fax. Number (if applicable): ..... ☐ (6)

Email address (if applicable); ..... ☐ (7)

Website address (if applicable): ..... ☐ (8)

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1. Indicate below whether the school has acquired any of the following new resources since the School Survey of Needs was completed in 1996.

Resource	Yes	No	
Electricity			☐
Telephone line/s			☐
Additional classrooms			☐
Other. Specify			☐☐ (9-13)

2. Tick which of the following technology items the school has available for teaching and learning purposes.

1	TV(s)	☐
2	Computer(s)	☐
3	Video Machine(s)	☐
4	Electric Radio(s)	☐
5	Wind-up Radio(s)	☐
6	Overhead Projector(s)	☐
7	Slide & Tape Projectors(s)	☐
8	Tape recorder(s)/CD player(s)	☐
9	Other. Specify _____	☐☐ (14-23)

3. Tick which of the following the school is likely to spend money on over the next two years.

1	Purchase of new classroom equipment (e.g. overhead projectors, chalkboards etc)	☐
2	Alterations to school building(e.g. maintenance of building, more classrooms, toilets, repairs to windows etc)	☐
3	Purchase of non-computer related teaching and learning resources (e.g. text books)	☐
4	Purchase of new stationary (e.g. pens, pencils, writing books etc)	☐
5	Teacher training	☐
6	Other. Specify _____	☐☐ (24-30)

4. Indicate in order of priority the three most important items the school is likely to spend money on in the next two years. *(Indicate the choices by using the numbers from the list above.)*

Choice 1: ☐

Choice 2: ☐

Choice 3: ☐ (31-33)

5. What factors prevent the school from acquiring computer facilities.

For Office Use

1 Limited classrooms that are suitable for computers ☐
2 Poor ventilation and lighting of rooms for computer use ☐
3 No electricity ☐
4 Power failures due to poor electricity supply ☐
5 No phone line ☐
6 Vandalism of equipment and facilities ☐
7 Poor security on school premises ☐
8 Obsolete computer equipment, which cannot be used for class room instruction or other educational purposes ☐
9 Lack of available staff trained to use computer equipment and software ☐
10 Other. Specify _____ ☐☐ (34-44)

6. Indicate in order of priority the most important factors that prevent the school from acquiring computer facilities. *(Indicate the choices by using the numbers from the list above.)*

Choice 1: ☐
Choice 2: ☐
Choice 3: ☐ (45-47)

7. Tick which of the following statements best describe the way most teachers at the school feel about the use of computers in education

1 Teachers strongly support the use of computers in education as they see computers as important in helping learners to think and work independently. ☐
2 Teachers feel that there is little value in using computers for learning ☐
3 Teachers see computers as an important source of information to access resources not available to them in the school ☐
4 Teachers feel that other needs should be given greater priority in the school ☐
5 Teachers feel that computers can be of use in preparing lessons and administrative tasks ☐
6 Teachers feel computer skills will provide learners with greater job opportunities ☐
7 Teachers are worried that computers will require of them to do further training ☐
8 Teachers believe that computers can be used to allow learners and teachers to interact with other schools through e-mail or joint projects. ☐
9 Teachers are concerned that any new technology will increase the work level of teachers ☐☐ (48-58)
10 Other. Specify _____

For Office Use

8. Indicate, in order of priority, the three most common feelings that teachers have about the introduction of computers in education. *(Indicate the choices by using the numbers from the list above.)*

Choice 1: ☐

Choice 2: ☐

Choice 3: ☐ (59-61)

9. Does the school have a mission statement/ school plan ?

☐ Yes ☐ No ☐ (62)

10. If <u>yes</u>, does the mission statement/school plan refer to technology in education?

☐ Yes ☐ No ☐ (63)

11. If <u>yes</u>, please attach a copy of the mission statement/school plan or write out below the section which refers to technology in education.

☐ (64)

12. If the school were to start using computers, why would it do so?

1 To prepare students for the future ☐

2 To attract students to the school ☐

3 To improve student learning ☐

4 To keep the curriculum and methods up-to-date ☐

5 To facilitate new forms of learning ☐

6 To offer the surrounding community access to computers for adult learning ☐

7 Other. Specify _____ ☐☐ (65-72)

13. Indicate in order of priority the most important reasons why the school would start using computers. *(Indicate the choices by using the numbers from the list above.)*

Choice 1: ☐

Choice 2: ☐ (73-75)

Choice 3:

14. Is there anyone at the school who is interested in developing and managing the use of computers in the school?

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☐ Yes ☐ No

☐ (76)

15. If yes, please indicate who the person is by ticking the appropriate column.

Position		Male	Female
1	Subject teacher		
2	Subject teacher with additional management responsibilities (e.g. deputy principal)		
3	Administrative member of staff (e.g. secretary)		
4	Principal		
5	Senior student		
6	Other. Specify		

☐☐ (77-78)

16. Indicate in order of priority the factors listed in Question 5 which prevent this person from developing the use of computers at the school. *(Indicate the choices by using the numbers from the list above.)*

Choice 1: ☐

Choice 2: ☐

Choice 3: ☐ (79-81)

17. What are the three most important conditions and resources which must be in place before the school is able to start using computers?

1 No specific conditions must be in place before the school is able to start using computers

2 The school must have a suitable room for computers

3 School must have access to electricity and have a phone line

4 At least one teacher must have sufficient training to run and manage the computers

5 All teachers must have some training in the use of computers

6 The school must be able to raise sufficient funding to maintain the computers

7 Parents must be informed about the use of computers and support their use in the school ☐

8 Other problems in the school must first be resolved (e.g. absenteeism, classrooms in poor conditions) ☐

9 Other. Specify _____ ☐☐ (82-85)

18. If the school introduced computers which grades would receive priority?

1	G1 – G3	2	G4 – G7	
3	G8 – G10	4	G11 – G12	(86)

19. If the school introduced computers, for what purposes would they be used?

1	Use of computers in school management and administration	
2	Computer use for staff professional development	
3	Computer use for lesson preparation	
4	Use of computers as a teaching and learning tool in all subjects	
5	To teach computer skills	
6	To expose students to the potential benefits of computers in everyday life	
7	Other. Specify _____	(87-94)

20. Indicate inorder of priority the purposes for which computers would be used. *(Indicate the choices by using the numbers from the list above.)*

Choice 1: .....

Choice 2: ..... (95-96)

21. Has the school ever been approached by a member of the private sector or any other source (e.g. NGO) about the <u>donation/leasing/loan</u> of computer resources to the school?

1	Yes	2	No	(97)

22. If <u>yes</u> indicate who has approached the school.

1	A private sector company	
2	NGO	
3	The provincial education department	
4	Another educational institution in the community (e.g. university)	
5	Other. Specify _____	(98-103)

23. If yes indicate what they have offered to the school.

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1 A donation of computer hardware ☐

2 A donation of computer software ☐

3 Teacher training courses/classes on computers ☐

4 Leasing of computers to the school with contract to provide teaching and training in the use of computers ☐

5 Other. Specify _____ ☐☐ (104-109)

24. Indicate below whether any members of the school community have access to computers outside of the school

Groups	Access at home	Access at another school	Access at a community resource (community centre, internet cafe)	Other (specify)
Management (e.g principal)				
Administration (e.g. secretary)				
Learners				
Teachers				

☐☐☐☐☐
☐☐☐☐☐
☐☐☐☐☐
☐☐☐☐☐
(110-129)

25. Indicate below any aspect of computers in education that you feel has not been covered in the questionnaire and/or the school believes should be elaborated upon.

☐ (130)

Thank you very much for your assistance.

C
Interview schedule

General

1. When and why did your school first start using computers?
2. Describe the process of development which has lead to the situation that you are at now with regard to your present computer facilities?
3. Describe how the school uses the computers which it has? That is:
   - Who uses them?
   - In what way are they used?
4. How effectively do you feel the school is using the computer resources which it has? Give reasons for your answer.
5. What, in your opinion, have been the main reasons why you have been able to successfully integrate computers into the learning and teaching process in the school (enabling factors)?
6. What has been the most significant benefit to your school arising from the introduction of computers?
7. What, if any, are your concerns about the impact which computer use may have on teaching and learning?
8. How supportive are the governing body towards the use of computers at the school?
9. If computers are only being used for school administration, what have the reasons been for not integrating them into the curriculum?
10. What in your opinion have been the main hindering factors to the provision and use of computers in the school?
11. How do you see the school overcoming these problems in the future?
12. What is your vision for the use of computers in your school in the future?
13. Do you feel that teachers and learners have benefited from the use of computers in the school?
14. Have you received any support from any of the following groups in setting up and making effective use of the computers?
    - Provincial Education Department
    - NGO
    - Governing body members
    - Other members of the community
    - Other schools
    - Other
15. Do you offer access to computer facilities or support to any other school or member of the community (e.g. Twinning, adult education centre)?

Computer Studies as a subject

16. When and why did you first introduce Computer Studies as a subject at the school?
17. Are the computers also used for teaching and learning in other subjects/learning areas?
    If yes, in what way and to what extent are they used?
    If no, why have you decided to limit computer use to the subject of computer studies?

18. What curriculum do you use for computer studies?
19. Who teaches the subject?
20. What are their qualifications and what path did they follow in developing the expertise to teach this subject?

Provisioning

21. Does the school own the computers which it uses?
22. If yes, where has the bulk of your funding for computers come from?
23. How do you maintain your computers?
24. Who is responsible for managing the computers and their use at your school?
25. Are they employed in a full-time or part-time post?
26. Do they have any other teaching responsibilities at the school or is this their main responsibility?
27. If yes, what are their other responsibilities?
28. If they are in a permanent post set up for this purpose, is this a government or governing body post?
29. If contracted out to a service provider, (e.g. Future kids), what is the nature of the contract which you have entered into with the service provider (duration, cost, etc.)?
30. What services do they provide?
31. Why did the school decide to go for this option?
32. How is the contract managed and to what extent is the school's management involved in the development and implementation of the programme/service?
33. How is the contract funded?
34. Thus far have you found this form of provisioning effective? If yes, why?
35. If no, what problems have been identified?
36. Do you see this form of provisioning as a viable option for the future or does the school see the need to change in the future (e.g. buy its own computers).

State responsibilities

37. What do you see the role of the provincial and national education departments as being in relation to ICT use in the schools?

Regional dynamics

38. Do you see the school as having a role to play in contributing to effective ICT development within all schools in the region?
39. If yes, explain how you see this role and what would be the potential challenges to you being able to play this role?

D

Interview guide for commercial firms

National survey on computers in education in South African schools

We would very much appreciate it if you could give us your perspective as a key role-player in government by offering brief notes according to the following guide. All your responses will be confidential. Only summary comments will be given in the final report.

1. What does your organisation sell to schools? Please tick all that are applicable.

Hardware	Content	Professional development
Computers	Subject software	Training for schoolchildren and/or teachers
Peripherals (printers, scanners, etc.)	Admin software	Certification via recognised authorities
Refurbished equipment	Learning tools (simulations, drill & practice routines)	Supply training software
Maintenance services	Tailor-made courseware	IT Consulting services
Connectivity	Radio and TV broadcast material	
LANs/WANs	Publishing of material for general release	Services as an outsourcer
Modems	Web-based content	
Provides internet service		
Leased lines		

2. Of those you ticked, which aspects generate the most revenue for your firm? Do they represent a minor, equal, or large part of your overall revenue stream? Please describe any trends you perceive towards growth or decline in these markets.
3. Who are the major suppliers in these sectors of the market?
4. What is the nature of the marketing channel (distributors, wholesalers, retailers, government departments, schools)?
5. Do you win orders via tenders for schools equipment/services? Please describe the process.
6. Do you win orders via direct sales to schools? Please describe the process.
7. If you are a 'preferred supplier' to a provincial or the national Department of Education how did you achieve this position?
8. In addition to a sales and marketing relationship, how else do you interact with schools (e.g., assisting with needs analysis, special donations, supporting the learning process)? Please describe any particular examples.
9. Do you have any international connections you use to develop the market for IT in schools? Please describe.
10. In what ways is IT in schools important in this country? Please comment.
11. What recommendations do you have for schools and education departments to help improve the use of IT in South African schools?

E

Interview guide for provincial education departments

National survey on computers in education in South African schools

We would very much appreciate it if you could give us your perspective as a key role-player in government by offering brief notes according to the following guide. All your responses will be confidential. Only summary comments will be given in the final report.

1. Does your department allocate funds to schools in your province for ICT infrastructure (computers, peripherals, software, Internet connections, etc)? *(Yes/No)*
2. If *yes*, how do you go about determining the amounts involved and their allocation to schools?
3. Do you look for matching funds from other sources?
4. Please describe the tender process you employ?
5. Over and above the basic requirements for hardware, software, etc., please describe any other added value you seek from the successful tenderer (e.g., implementation support, training, maintenance, etc.).
6. What else should education departments be doing to ensure the best long-term deployment of ICTs in schools?
7. Please list some IT-related firms with whom you have done business, or you know to be supplying equipment or services to schools in your province.
8. Do you have a technology policy or plans relevant to computers in your schools? If so, can you please forward it to me or advise whom I should speak to about it?

F

Summary feedback from ICT suppliers in the private sector

Organisation	Contact people	Products/services supplied
IBM	Alf Kale, Yvette Hitler, Richard Vernon	Computers
Main sales revenue from schools is from PCs but this is a minor part of overall revenue stream. Works through reseller chain. Through them offers a 10% discount to schools. Sees a decline in demand as government subsidies decline. Helps schools with tender process. A preferred supplier to Nat Educ. Dept., and Northern, North West and Western Cape provinces. Donations through Reach and Teach, ACE. Helps with Technical Support Plans and capacity building, e.g., offers concession rates to government.		
Hewlett Packard	Henry Sabata	Computers
Very diffident about schools market. Is in partnership with Gauteng Educ. Dept. and TechEd on their schools project. Via Africare has also partnered with Microsoft on 'Digital Villages' in Soweto and Kimberley. No special deals reported.		
Apple	Brian Seligman	Computers
Contrary to USA and elsewhere, and given tiny market share in SA, has minimal involvement with schools, but some activity at tertiary level.		
Compaq	Nicholas Griffin	Computers
Hardware to schools a minor part of overall revenue stream, but a definite growth trend seen. Responds to tenders at provincial and national level. Also works directly with private schools. Mentioned the I CAN Foundation as a not-for-profit initiative through which they channel social responsibility activities. Another source reported major schools discounts for Compaq equipment but this was not confirmed.		
Nova Computers	Steve Perret	Computers
A company of five people in the Western Cape who supply computers, communications equipment, peripherals and software to various bodies, like municipalities, institutes, Armsco, and schools. They supply several schools with their ICT needs, that aspect making up about half their business. They note that the schools sector is difficult to handle, with the expected funding problems, and a strong need for ongoing hands-on maintenance and repair.		
Brother Business Machines	Daan Coetzee	Computers
They are on the National Educ. Dept.'s list of preferred suppliers. They respond to tenders but say they do not know whether the end point of the equipment is schools or not. They state that they only supply to the national and provincial depts. of education for administrative uses.		
Business Mann	Attie Kriel	Computers
A local PC dealer in Western Cape. Say they do very little with schools because they emphasise quality and schools tend to purchase 'cheap and nasties'.		
3Com	Alex de Jager	Communications equipment
Offers hubs, switches, network cards, modems, etc. Deals with schools on a case-by-case basis, but guarantees better discounts than to any commercial client.		
CISCO	EPU	Communications equipment
CISCO is in active partnership with others in social responsibility projects like NetDay. In line with CISCO's schemes worldwide they also offer special educational discounts through the reseller chain, provided those outlets are classed as 'educational partners'. The company has started to roll out 'CISCO Networking Academies' in the USA, and is aiming to set up 30 in South Africa next year. These will be in secondary and tertiary institution. The first has been established at Houwteq in Grabouw, and the second will be launched at the University of Pretoria in August 1999. Institutions require an Internet Lab and will then receive support in cash and kind to develop curriculum and install equipment like routers.		
Novell	Mandy Booysen	Networking software
Offer special deals for their networking products to educational institutions worldwide. However, they stated a lower limit for costing as 2 500 students.		
Symantec	Mohammed FSA	Software
All Symantec products at about 1/3 retail prices.		

Organisation	Contact people	Products/services supplied
Corel	Ernest Rampete	Software
The Corel License for Learning (CLL) allows a school to use Corel Draw, Corel WordPerfect Suite, Corel Office Professional, Corel Ventura, Corel Webmaster Suite and lastly Corel PrintHouse on as many computers as they have. CDs can be put into the library for learners to take home and install on their home computer. The school will have to purchase the Academic Package of each of the products they want to use. The cost for a secondary school is R6 000.00 every 3 years. The cost for primary schools is R2 400.00		
Interware	Pieter Waker	Software
Cape-based national supplier of software to schools. Represents USA and UK software publishers in SA. Has noticed a 50% p.a. growth in demand for software in recent years with an emphasis on application packages. Deals directly with schools rather than through educ. depts. Microsoft products by far the largest segment with Borland, Symantec and Corel minor players.		
Adobe	Bernice FSA	Software
10-pack educational licenses at same price as single retail license.		
Microsoft	Leanne Steer	Software
Schools represent a minor but growing part of overall business. Works through 300 resellers. Range of software at about 1/3 retail price. Works with overseas principals to share experiences and what works. Makes donations of software to schools. Provides a comprehensive (USA-developed) Technology Roadmap to help schools plan and implement computer technology in schools. Will shortly announce the Microsoft School Agreement which will license PCs for a whole list of Microsoft products on an annual basis (including upgrades and home use for teachers).		
Telkom	Lulu Letlape	Connectivity
Offers dialup and leased line connectivity to schools at commercial rates. Also, through the Telkom foundation has supplied nearly 1 000 schools with one computer each, a year's free connectivity to the Intekom service provider and up to R150 a month in free Telkom usage. The Internet 1 000 project is being enhanced in two ways. First, 100 of the 1 000 schools will be selected to establish computer centres of approximately twenty computers each, to be used as local resource centres for other schools. Second, teachers in those schools will receive advanced training after the July holidays. Thintana, the consortium of Telkom shareholders is funding a parallel project, Internet 2000, whereby 2 000 computers will be deployed in 200 schools. Further implementation in both these projects is through SchoolNet SA.		
Internet Solution	Alison Wright	Leased lines and Internet services
Direct supply of Diginet lines to schools, but this is a minor part of their overall business. Lots of growth expected. Sales reps approach schools, initiate an order, handle Telkom for the connection and complete domain registration, etc. Have a social responsibility project with SchoolNet, sponsoring the line and traffic on four 64kb lines for SchoolNet operations. Now have a long-term relationship that is extending into schools and communities.		
Futurekids	Michael Plumstead, Thys du Preez	Technology syllabus and methodology for students; teacher training
Primarily based on US syllabus and learning methods. Currently developing localised outcome-based curriculum and lesson plans for schools. Futurekids is now licensed in 108 countries, has signed up 70 franchisees and are in about 200 schools in SA—mainly, public, rural and primary. Pricing is per student per month. Also sell/rent hardware and software but encourage hardware rental by schools. Have sole rights to teach FDE (Computer Assisted Education) on behalf of University of Pretoria. Seeking accreditation with SAQA and wants to be an approved supplier endorsed by national department. Methodology based on technology learning via academic themes. Believes the countries making best use of computers are: Israel, Brazil, Argentina and USA.		
Computers4Kids	Charmaine Roynon	Student and teacher training Outsourcing of facilities and services
Western-Cape based company, expanding nationally. About 15 schools using proprietary syllabus and methods for learning ICT skills. Strengths are integration with school curriculum, SA orientation, employment and ongoing training of fully qualified teachers, personal service, flexibility in offerings.		
K-Net	Transcribed interview by EPU	Skills training
An SA company offering technology skills training. K-Net Partner Schools Programme. Also offers complete networking service. Helps schools assess needs for technology training and quotes to do full job. Has offered to provide list of client schools.		
New Horizons	Valerie	Training
Offers a full range of applications training courses. Has a Club offer including a discount for training completed in six months or a year. About to launch an offer for students and teachers. Accredited by the CSSA for the ICDL.		
Tecor	Transcribed interview by EPU	
Computer-based education and training and Internet access for students and teachers. Sec 21 company: *Imfundo Yesizwe* launched with St Alban's and CSIR. Planning to set up 20-PC labs with Internet access and use Cybis and Virtual Campus system to access many on-line courses. Focus is much broader than just ICT training. This is a computer-based training initiative for disadvantaged communities: schools as well as communities.		

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